MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The Monthly Weather Review for June, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San Jose, Costa Rica; Capt. François S. Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq. Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the Review, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. Garriott, in charge of Forecast Division.

Over the greater part of the United States the spring and early summer of 1902 has been unseasonable.

From the Rocky Mountain districts to the Atlantic coast the advent of spring weather was delayed until the first decade of April by a remarkable succession of general storms that appeared in the West and Northwest, swung south of east over the central valleys, and moved thence north of east to the Atlantic coast. May was notable chiefly for the unusual frequency of frost in the northern tier of States.

In June the temperature was low, with excessive rainfall in the North, while in the South high temperature and semi-drought conditions prevailed. In the middle latitudes of the country, where the monthly temperature and rainfall corresponded closely with the June average, the means were a product of extremes that obtained during periods of excess and deficiency in temperature and rainfall. The general atmospheric conditions over the United States, that were associated with the unseasonable weather of June, appear on the weather maps as a succession of general storms that crossed the northern part of the country and a prevalence of relatively high barometric pressure over the Southern States.

Five storms of moderate intensity advanced from the coast of the United States over or near Newfoundland in June. One of these storms first appeared over the Gulf of Mexico, passed northeastward along the Atlantic coast of the United States during the 15th and 16th, was central over the Canadian Maritime Provinces on the 17th, and passed northeast of Newfoundland during the 18th. This disturbance was located over mid ocean on the 19th, and on the 20th its approach was indicated by reports from stations on the west coast of Ireland, where a barometric pressure of 29.24 inches was reported at Valentia. During the 21st and 22d this storm moved northward off the west coasts of Ireland and Scotland. From the 11th to the 13th a disturbance moved southeastward over the British Isles, with barometric pressure of 29.40 inches at London on the 13th; during the 14th and 15th this storm area passed northeastward over the North Sea. From the 23d to the 29th a well-marked disturbance moved slowly from New England over the Canadian Maritime Provinces and Newfoundland, with lowest reported barometric pressure, 29.20 inches, at Montreal on the 26th.

In the Lake region notable storms occurred on the 25th, and from the 28th to the 30th. The storm of the last three days of the month on the lakes first appeared near the mouth of the Rio Grande River on the morning of the 26th, moved northeastward inside the coast line of Texas during the 27th,

and the center reached the Mississippi River, between Cairo and St. Louis, by the evening of the 28th. On the morning of the 29th the center was over Ohio, where it remained nearly stationary, with diminishing strength, until the close of the month. No general storms of marked intensity occurred on the Pacific coast.

During the third decade of the month severe local storms, heavy rain, and high winds occurred in parts of the Lake region and the Ohio and middle and upper Mississippi valleys. In Missouri and Illinois crops were damaged by heavy rains.

The noteworthy frosts of the month occurred in the North Atlantic States on the 10th and in the Northwestern States on the 20th.

Ample warning was given of the general storms that visited the coasts and Great Lakes.

BOSTON FORECAST DISTRICT.

The only conspicuous features of the month were the moderate gales of the 7th, 9th, and 10th, for which warnings were displayed, and the general and severe frost of the 10th, which was announced in the morning forecast of the 9th—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

The third decade of the month was stormy, and the severest weather resulted from the Gulf storm of the 26–27th, in connection with which ample and timely warnings were issued.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

Storm warnings were ordered on the three upper lakes on the morning of the 25th, and on Lakes Michigan and Huron during the afternoon of the 28th. The storm of the 25th was not severe. The second storm, that had moved from the western Gulf of Mexico, was very severe over the southern part of the Lake region. An extensive frost, for which warnings were issued, occurred in the Northwestern States on the morning of the 20th. The month was marked by an unusual amount of rainfall over almost the entire district, and abnormally cool weather during the last half of the month, and these conditions were generally forecast.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

No special warnings were issued during the month.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The weather of the month was not marked by notable abnormal features and no special warnings were issued.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The rainfall was deficient, and light frost, for which warnings were issued, occurred on several mornings.—*E. A. Beals, Forecast Official.*

RIVERS AND FLOODS.

Fairly good navigable stages of water prevailed in the principal rivers of the United States during the month of June, especially in the Mississippi and its western tributaries. Except from St. Paul, Minn., to Dubuque, Iowa, where there was very little change, the mean stages of the Mississippi were considerably higher than those of the preceding month, the excess being most notable from Galland, Iowa, to Vicksburg, Miss. In the Missouri River the mean stages, at all points from which reports were received, averaged about four feet higher than during May, and on the 11th of the month the danger lines were nearly reached at St. Joseph and Kansas City, Mo. The eastern tributaries of the Mississippi were generally lower than at the close of May, the changes being slight in the Ohio and Tennessee rivers, but more pronounced in the Cumberland. Slight floods occurred in the upper portion of the Red River from the 1st to the 7th, and the danger lines were reached or exceeded during the month in the Pedee, Wateree, and Willamette rivers, but little if any damage resulted to growing crops or other property.

The highest and lowest water, mean stage, and monthly range at 138 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are: Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*George E. Hunt, Chief Clerk Forecast Division.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	3, a.m.	53	114	7, a. m.	32	65	3,125	4.0	781	32.5
II	5, p.m.	48	125	9, p. m.	39	75	2,900	4.0	725	30.2
III	14, p.m.	50	111	18, p. m.	32	65	2,800	4.0	700	29.2
IV	19, a.m.	52	122	24, a. m.	37	76	3,325	5.0	665	57.7
Sums							12,150	17.0	2,871	119.6
Mean of 4 paths							3,038		718	29.9
Mean of 17 days									715	29.8
Low areas.										
I	*31, a.m.	39	120	5, a. m.	47	54	4,000	5.0	800	33.3
II	4, p.m.	47	112	9, a. m.	46	60	3,025	4.5	672	28.0
III	13, a.m.	23	82	18, a. m.	47	54	2,675	5.0	535	22.3
	13, p.m.	44	104				2,575	4.5	572	23.8
IV	16, a.m.	48	115	20, a. m.	47	65	2,550	4.0	638	26.6
V	20, a.m.	35	90	21, p. m.	46	78	1,075	1.5	717	29.9
VI	23, p.m.	44	116	27, a. m.	48	68	2,825	3.5	807	33.6
VII	24, a.m.	33	115	29, p. m.	39	75	3,200	5.5	582	24.3
	26, p.m.	28	97				1,875	3.0	625	26.0
VIII	27, p.m.	32	106	† 1, a. m.	42	71	2,425	3.5	693	28.9
Sums							26,225	40.0	6,641	276.7
Mean of 10 paths							2,622		664	27.7
Mean of 40 days									656	27.3

*May. †July.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk Forecast Division.*

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following summaries relating to the general weather and crop conditions are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau:

Alabama.—Excessively hot and dry, and unfavorable for all growing crops. A drought, which began during middle of April, continued practically unbroken over the greater portion of the State; in some central counties absolutely no rain was received during the month.—*F. P. Chaffee.*

Arizona.—High, drying winds and extremely arid conditions have arrested full plant development. The harvesting of barley and wheat in the lower agricultural valleys was finished during the month. The yield was generally below the average, but the product was of good quality. The water supply for irrigation has been reduced to a minimum, and alfalfa fields have suffered correspondingly. The range interests are in a precarious condition.—*Wm. G. Burns.*

Arkansas.—Warm, dry weather prevailed during the first two decades of the month. A spell of abnormally cool weather prevailed from the 20th to the 25th, accompanied by local showers, heavy in some places. Heavy general rains began on the 27th, and continued intermittently until the close of the month. Conditions favored cotton; it advanced rapidly and was blooming and fruiting well. Corn suffered considerably from dry weather during the month, wilting and turning yellow. The heavy rains at the close of the month improved it, though some slight damage was done by lodging, caused by the high winds and heavy rains. Wheat has been harvested and garnered, and thrashing is progressing. Oat harvesting has been completed and thrashing had begun; the yield is from poor to fair, only a very few localities reporting an average yield. Peaches improved considerably toward the close of the month, but apples continued to fall. Pastures and gardens were greatly benefited by the heavy rains.—*Edward B. Richards.*

California.—Nearly normal weather conditions prevailed during the month. Fires destroyed several hundred acres of grain. Grasshoppers caused considerable damage to vineyards and grain in the San Joaquin and Sacramento valleys. Grain harvest was in progress in all sections at the close of the month, and there was a heavy yield in most places north of the Tehachapi. Deciduous fruits were yielding bountiful crops.—*Alexander G. McAdie.*

Colorado.—For the State as a whole the precipitation was about three-fourths of the normal. The volume of water for irrigation was exceptionally small, notwithstanding the fact that June is usually the month when the streams fed by melting snow are at very high stages. The scarcity of water was not unexpected, however, in view of the light snowfall of the past winter; there were no heavy rains in the mountains to offset the deficiency. Following the copious precipitation that occurred during the latter part of May a rapid improvement was noted in the condition of crops. This improvement, however, was of short duration. Drying winds prevailed, and as the rainfall was insufficient to make up for the absence of irrigation many fields were soon past recovery, while others gave promise of much less than normal returns. Irrigated crops made very satisfactory advancement, but the area actually irrigated was very small as compared with that of the average season. The first cutting of alfalfa was harvested during the month, the yield being generally light. Wheat, oats, and rye suffered from the drought, and grasshoppers caused considerable injury in the north-central counties. Corn and potatoes continued thrifty. The eastern ranges afforded excellent pasturage; elsewhere the grass dried rapidly and short pasturage was reported in the western and south-central counties. The conditions were favorable to fruits. Strawberries were plentiful, and a large crop of cherries was marketed. Hail was frequent during the closing days, and caused considerable damage in the north-central section.—*F. H. Brandenburg.*

Florida.—The month was noted for high temperatures and a decided deficiency in precipitation. There are portions of the State where no rain fell during the month. As a consequence corn has been badly damaged. Cotton on uplands was needing rain at the close of the month, although the plant made a fair growth; it fruited slowly. Tobacco, cane, velvet beans, and vegetables suffered for rain. Pineapples were shipped in large quantities; the fruit was not so fine as in former years.—*A. J. Mitchell.*

Georgia.—June was a warm month, with abundant sunshine, a decided deficiency in precipitation in the northern section, and large excesses in some of the southern counties. The lack of moisture in many counties was damaging to crops, but the generally fair weather afforded fine opportunity for cultivation. Cotton withstood the drought well, and at the close of the month the crop was generally in good condition, although the plants were small for the season. Upland corn, gardens, and melons were badly injured by the dry weather. Late peaches suffered extensively from shedding and rotting.—*J. B. Marbury.*

Idaho.—There were no storms of general character during the month, but high, drying winds occurred in the southeast sections from the 13th to 19th, and in the northern counties from the 23d to 27th. Crops in dry farm sections suffered for want of rain, but in irrigation districts, with few exceptions, the water was more abundant than usual. Hay, wheat, oats, flax, apples, pears, and prunes are in excellent condition.—*S. M. Blandford.*

Illinois.—The weather was warm the first half of the month, but the latter half was unseasonably cool; showery weather prevailed throughout the month in the northern and central districts, but generally dry weather prevailed over the southern district until the end of the month, when heavy rains fell throughout practically the entire State. Crop conditions were very favorable over the northern and central districts during the greater part of the month, the showers and warm weather of the first half having caused a rapid growth of vegetation. Oats grew rank, however, and lodged to some extent, and the wet weather delayed corn plowing. In the southern district crop conditions were decidedly less favorable than farther north on account of the dry weather, but the heavy rains of the latter part of the month have caused considerable improvement.—*M. E. Blystone.*

Indiana.—An unusual number of severe electrical, hail, and windstorms, as well as excessive rainfalls, were recorded during the month. The planting of corn in the north section was delayed, and after it came up the crop suffered from excessive moisture. At the close of the month, however, corn was in fair to excellent condition in all sections. Clover harvest was delayed, some hay was lost and much damaged by frequent rains. Oats made splendid growth, were heavy and ripening, but badly lodged. Wheat was cut in the south section, harvest had commenced in central section and the grain was ripening in north section. Early potatoes were yielding well. The apple crop was light and the fruit falling. Strawberry, blackberry, and raspberry crops were light. Melons, tobacco, and all vegetables were doing well.—*W. T. Blythe.*

Iowa.—The month was unseasonably cool, wet, and cloudy, and extensive areas were flooded, causing much damage to crops on river bottoms and low lands and retarding farming operations. Continued wet weather caused a rank growth of oats, barley, and spring wheat, developing a tendency to lodge and rust. But despite the adverse conditions fair progress was made in cultivating corn, and at close of month three-fourths of the corn acreage was fairly clean and promising. Grass, potatoes, and garden truck made great advancement. The apple crop was below the average.—*John R. Sage.*

Kansas.—A fine month for growing crops. Wheat harvest began the first week, but owing to the excessive rains was not finished the last week. Oat harvest began the third week, an unusually fine crop. Corn grew very rapidly, with a fine stand and good color. Potatoes very abundant and fine. First crop alfalfa cut under difficulties, and much was lost; second crop fine and being saved in good condition. Hay very fine.—*T. B. Jennings.*

Kentucky.—During the first half of the month the temperature was about normal, and with the exception of a few of the southern and western counties, where droughty conditions prevailed, there was sufficient rainfall for the growth of crops. The latter half of the month was very cool, checking the growth of vegetation. In some of the south-central counties the drought was quite severe until the last week, when abundant rains visited all sections, generally improving crop conditions. Some localities reported damage by heavy wind and floods, but the area affected was not extensive.—*H. B. Hersey*

Louisiana.—The month was unusually dry, the rainfall being insufficient for the needs of crops, except over the northwest portion of the State. Warm weather favored plant growth where rainfall was sufficient. Cotton made very slow growth over the central and southern portions of the State, and at the close of the month the plant was reported small generally and was blooming to the top. Sugar cane made very little growth during the month, and notwithstanding the drought it retained a healthy color in most sections. The plant was reported unusually small for the season and needed general rain. Rice suffered for rain, except where water was sufficient for irrigation. Early rice was maturing at the close of the month. Corn suffered seriously for the want of rain.—*I. M. Cline.*

Maryland and Delaware.—Brief warm spells helped crops, but the prevailing cool weather was unfavorable, and some loss to tender vegetation resulted from frosts in the extreme west. The generous rains that fell on and after the 7th were very beneficial, however, and changed the crop outlook from one of gloom to much promise. Wheat harvest progressed rapidly, giving light yields of a fine quality of grain; clover gave very poor returns; timothy improved during the month; buckwheat was about all sown in the west; oats improved; tobacco rallied to a marked extent, and the stands, though uneven, are in the main satisfactory. Fruit of all kinds fell considerably; gardens made rapid growth after the rains and yielded bountifully. The 17-year locusts have about all disappeared; they did no damage to field crops, but left the marks of their brief sojourn on fruit and forest trees.—*Oliver L. Fassig.*

Michigan.—The excessive precipitation interfered greatly with field work of all kinds, while the cool weather retarded the growth and germination of corn, beans, and garden truck. Cultivation of all kinds has been very backward during the entire month. Wheat, rye, oats, barley, meadows, and pastures made good progress, the cool, wet weather being very favorable until the latter part of the month, when rain became excessive and delayed the maturing of wheat, rye, and hay. Excessive moisture also delayed the planting of late potatoes and thinning of sugar beets. Corn made very poor progress, although it germinated quite nicely; at the close of the month it was small and of rather poor color. Light frosts occurred in nearly all counties of the State as late as the 26th, but the damage in most cases was confined to low ground and was slight. At the close of the month clover haying had begun, but was making very poor progress on account of the frequent showers.—*C. F. Schneider.*

Minnesota.—The weather was dry in the southwest till the 24th; elsewhere there were well distributed showers, some of which in the southeast were heavy enough to cause high water. A tornado on the 9th in parts of Norman, Clay, and Becker counties caused the deaths of 6 persons and damaged crops, farm buildings, etc. Hailstorms destructive to crops and buildings occurred in Renville, McLeod, Sibley, and Rice counties on the 14th. Frosts in the southwest on the morning of the 21st caused temporary injury to corn, gardens, etc. Spring wheat, oats, and barley grew well all the month. Flax seeding on new land continued into the middle of the month; the early seeded was in good condition. Most of the potatoes were planted by the 1st; they grew well and were in market by the end of the month. Corn had a good stand, but the cool weather kept it small and backward. Old timothy was good, but that seeded last season poor. Clover cutting began late in the month.—*T. J. Outram.*

Mississippi.—The month was characterized by excessively high temperatures (being the warmest June on record) and a marked deficiency in rainfall except in the extreme northern counties, where the monthly precipitation was slightly above normal. At the beginning of the month crops were generally clean and in a healthy growing condition, except in some of the eastern counties, where they were commencing to need more moisture. The drought over the greater portion of the State during June almost ruined early corn, injured late corn, stopped the growth of cotton, causing it to bloom to the top, and was very damaging to minor crops. During the last week of the month cotton was further injured by the high southerly winds, and considerable early corn was being cut for fodder, except in the extreme northern counties, where copious showers proved very beneficial to all crops. Peas that were sown when corn was laid by, generally failed to germinate, and pastures, gardens, and fruit deteriorated quite rapidly on account of the dry, hot weather.—*W. S. Belden.*

Missouri.—Unseasonably cool weather during the latter part of the month checked the growth of corn and cotton to some extent, and heavy rains during the last decade interfered with harvest and caused some damage to standing grain and also to that in shock. Excessive rains in localities also resulted in much damage to crops on bottom lands by the overflowing of streams. Otherwise the weather conditions of the month were very favorable, and the outlook for all crops, except fruit, was most encouraging.—*A. E. Hackett.*

Montana.—Weather very cool during the month, which retarded the growth of crops and vegetation. The season is about three weeks later than the average.—*E. J. Glass.*

Nebraska.—The first half of June was warm and wet and all crops made rapid growth; winter wheat especially filled well and promised a large crop; oats made a very rank growth and in some places began to lodge slightly. The last half of June was very wet and cool; frost on the morning of the 21st damaged field crops slightly in the northern counties. The wet weather interfered seriously with the harvesting of winter wheat and caused oats to lodge badly. The heavy showers flooded the lowlands and valleys, causing considerable damage to all crops. The wet condition of the soil retarded cultivation of corn and many fields were weedy. The crop, as a rule, was in excellent condition at the end of the month, although rather small and quite uneven in size. Potatoes and grass made excellent growth and promised a very large yield. Peaches were very poor; early cherries only a light crop; apples promise much better than either peaches or cherries.—*G. A. Loveland.*

Nevada.—The month was very much drier than usual all over the State; temperature conditions were about normal. Irrigation water was plentiful in the eastern, western, central, and northern sections, but rather short in the south portion. The progress of all crops was rapid and satisfactory. Haying progressed throughout the month and the yield was about the average in most districts. Range grass was fairly good and live stock improved in condition.—*J. H. Smith.*

New England.—Weather abnormally cool, with sunshine deficient and rainfall generally in excess. Crops were backward and growing slowly. Corn promised a short crop. Gardens were good, potatoes excellent, and tobacco very promising. Apples, except Baldwins, promised an average crop of excellent quality. Peaches and pears fair crops.—*J. W. Smith.*

New Jersey.—Owing to low night temperatures, all crops at the close of the month were behind the seasonal average, especially corn and tender vegetation. The rainfall was the greatest since 1887, when it averaged 6.77 inches. It was badly distributed, the extreme northern portion receiving the least and the southwestern portion of the interior the greatest amounts.—*Edward W. McGann.*

New Mexico.—Dry and windy, with unusually high temperatures during the last decade. A scarcity of grass and water on the stock ranges before the close of the month, and the Rio Grande dry from Albuquerque south. Very little planting on "temporal" lands on account of the drought.—*R. M. Hardinge.*

New York.—The month was decidedly cool and wet. Light frosts occurred in the cooler sections from the 5th to 9th and on the 23d and 24th, but did very little damage. Farm work was much delayed by wet weather, and checked growth of corn, beans, and tobacco. Sowing buckwheat and planting beans were backward, and the hay harvest was also hindered, and the crop light. Peaches, pears, and plums were largely destroyed by frost in May, but many correspondents report the crop of late apples as very promising. Considerable damage was done by floods.—*R. G. Allen.*

North Carolina.—During the first two weeks of the month the progress of vegetation was seriously impeded by drought. During the latter half of the month conditions changed for the better, rains having been general on the 15th and 16th, and during the remainder of the month in sufficient quantities to repair previous damage. Early planted cotton did not suffer to any material extent. Corn stood the drought well, and under the influence of generous rains was coming into silk and tassel rapidly at the end of the month. Tobacco suffered severely, and while it was benefited by the rain did not come out well in some sections. Gardens suffered severely, and a full crop of sweet potatoes could not be planted on account of the scarcity of slips.—*R. M. Geddings.*

North Dakota.—The month, although cooler than usual, was very favorable for crops of all kinds, except corn, for which there was not sufficient sunlight and warmth. Wheat, rye, oats, barley, flax, and grass were all in excellent condition.—*B. H. Bronson.*

Ohio.—Grain lodged by the storms and harvesting delayed; corn backward in the north; oats improving and heading well; clover cutting delayed; timothy, pastures, and grass improved, but can not overcome effects of early drought; early potatoes promising; gardens and tobacco doing well; apples continue dropping; pears variable; peaches light; grapes promising.—*J. Warren Smith.*

Oklahoma and Indian Territories.—The weather during the month was favorable for the progress of farm work and advanced the growth of crops until toward the close of the month, when some damage was done to corn and gardens by hot, drying winds. The precipitation was light over Oklahoma, but fairly well distributed, and fell when most needed; over Indian Territory the precipitation was generally in excess of the usual amount and farm work was delayed by wet ground. Wheat harvest was well advanced and thrashing in progress at the close of the month, with yields ranging from poor to good and the grain short in weight and of medium quality. Oat harvest about completed. Corn, cotton, castor beans, millet, flax, cane, kaffir, and broom corn were in good condition. Early apples, peaches, and plums matured and were yielding well.—*C. M. Strong.*

Oregon.—The weather during the month was generally favorable for the growth of vegetation, but a trifle too cool for the rapid advancement of spring wheat, corn, and garden truck. Haying became general during the second week; fall grain headed during the latter part of the month.—*Edward A. Beals.*

Pennsylvania.—The month as a whole was cold and wet. Seeding, planting, and germination were retarded and but few crops made normal advancement. The average precipitation exceeded that of any corresponding month in the fifteen years covered by the records, and the mean temperature was, with the exception of June, 1897, the lowest mean for this month during the same period. A few flakes of snow were noted in Washington and Center counties on the 23d. Light frost was recorded at widely separated points on various dates between the 6th and 25th and heavy frost at Wellsboro on the 9th. At the close of the month wheat harvest was in progress in some districts, and, though the straw was short, the heads were generally well filled and the grain of good quality; oats were improving and heading and the outlook was favorable for a fair crop; the second crop of hay had started nicely and a satisfactory yield was anticipated; pastures were furnishing ample feed; a large acreage had been prepared for buckwheat and some fields sown; garden truck and other vegetables were making little if any advancement and higher temperatures and sunshine were needed to insure proper development and maturity.—*T. F. Townsend.*

Poto Rico.—All crops of the island were more or less injured, some partially, others totally destroyed, by the heavy and continuous rains that fell during the first three weeks of the month and by the lack of sunshine and cultivation; crops along the river banks were damaged or destroyed by overflows. Weather conditions improved during the last week; field work was generally and actively resumed, and crops are now rapidly recovering. The cane crop suffered very severely; mature canes deteriorated, newly cut fields failed to rattoon well, and the young canes were checked in their growth. Coffee trees in some places shed a large per cent of their berries and blossoms were damaged by the heavy rains. Some loss to the corn crop, as it was impossible to harvest it; beans and frijoles almost wholly lost, but the rice crop did well.—*E. C. Thompson.*

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the mean temperature, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, June, 1902.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	80.8	+2.5	Decatur	106	12	Valley Head	47	22	1.28	−3.29	Tuscumbia	4.81	Verbena	0.00
						Ashville		23						
Arizona	81.6	+1.7	Aztec	125	22	Ashfork	23	1	0.12	−0.09	Fort Huachuca	1.03	Many stations	0.00
Arkansas	77.5	0.0	New Gascony	105	19	Oregon, Wiggs	42	23	5.27	+1.37	Eureka Springs	9.28	Lake Village	0.59
California	70.2	+0.3	Volcano	129	23	Bodie	10	2	0.10	+0.18	Crescent City	1.93	Many stations	0.00
Colorado	63.4	0.0	Blaine	110	26	Breckenridge	14	21	1.11	−0.32	Wray	5.69	Buenavista	0.00
Florida	80.7	+0.8	Eustis	103	30	Quincy	53	3	5.95	−1.20	Pinemount	15.01	Molino	0.00
Georgia	79.5	+1.4	Rome, Tallapoosa	103	12	Ramsey	49	23	3.54	−1.17	Waycross	9.59	Tallapoosa	0.70
			St. Marys		30									
Idaho	60.0	−0.1	Garnet	106	9	Forney	21	5	0.71	−0.18	Murray	1.69	Blackfoot	T.
Illinois	69.5	−3.0	5 stations	100	11-15	Lanark	38	22	7.90	+3.69	Mattoon	14.83	Equality	1.84
Indiana	69.6	−2.6	Washington	101	12	4 stations	39	23	7.48	+3.34	Rensselaer	13.90	Evansville	3.17
			Vincennes		14									
Iowa	65.2	−4.8	Keosauqua	97	10	Sibley	32	22	7.16	+2.90	Grundy Center	16.04	Sheldon	1.46
Kansas	70.9	−3.3	Gove	106	10	Abilene	34	20	6.04	+1.89	Columbus	12.45	Lakin	0.48
			Viroqua		26	Achilles		21						
Kentucky	73.4	−1.3	Bowling Green	101	12	Manchester	39	22	4.75	+0.31	Taylorsville	7.63	Franklin	1.40
Louisiana	81.6	+2.0	5 stations	103	10, 11, 18, 19	Amite, Robeline	50	23	1.84	−1.30	Plain Dealing	12.52	Sugartown, Venice	0.00
Maryland and Delaware	70.1	−1.3	Boettcherville, Md.	104	14	Deer Park, Md.	31	8, 24	4.91	+1.43	Sudlersville, Md.	9.00	Clearspring, Md.	1.89
Michigan	59.8	−4.6	Jackson	94	15	Wetmore	25	5	5.12	+2.28	Ball Mountain	10.40	Thomaston	1.13
Minnesota	61.3	−4.0	Currie	94	15	Tower	29	23	3.32	−0.69	Pleasant Mounds	8.53	Bermidji	1.09
Mississippi	81.4	+2.4	Aberdeen	106	6	Duck Hill	47	23	1.51	−3.34	Austin	6.19	Shoccoe	T.
Missouri	70.9	−3.2	St. Charles	100	11	Edwards	37	22	6.68	+1.94	Mount Vernon	12.55	Lamonte	2.55
Montana	56.5	−3.0	Billings	100	9	Yale	21	2	2.08	−0.21	Lewistown	6.00	Dell	0.16
						Adel		20						
Nebraska	66.4	−3.2	Madrid	105	10	Lynch, Nesbit	31	21	5.12	+1.20	Wilber	12.89	Springview	1.40
Nevada	66.3	+1.1	Rioville	116	24	Palmetto	20	1	0.04	−0.36	Eureka	0.30	Several stations	0.00
New England	61.3	−3.6	Nashua, N. H.	94	3	Fort Fairfield, Me.	20	1	4.30	−1.42	Newport, Vt.	8.51	Boston, Mass.	1.77
			Norwalk, Conn.											
New Jersey	67.5	−2.2	Vineland	99	13	Layton	38	24	6.57	+3.03	Woodstown	10.21	Layton	4.54
New Mexico	72.7	+2.1	San Marcial	113	25	Winsors	27	23	0.40	−0.64	Carlsbad	3.54	Deming, Galisteo	0.00
New York	61.3	−4.2	Primrose	92	3	Axton	28	6, 11	5.15	+1.73	South Kortright	8.41	Greenwich	3.02
North Carolina	74.5	+0.1	Southern Pines	103	12	Linville	36	9	4.50	+0.13	Settle	9.72	Kittyhawk	1.68
North Dakota	58.0	−5.4	Napoleon	97	9	New England City	28	8	3.65	−0.04	Falconer	6.30	New England City	1.00
						Dunsieth, Gallatin		21						
Ohio	66.9	−3.3	4 stations	98	12, 13, 15	Orangeville	33	9	7.48	+3.95	Wellington	10.88	Kilbuck	3.21
Oklahoma and Indian Territories.	77.4	+0.2	Healdton, Ind. T.	110	25	Blackburn, Okla.	43	21	2.42	−0.81	Tahlequah, Ind. T.	6.98	Fort Sill, Okla.	0.20
			Ryan, Ind. T.			Taloga, Okla.		22						
Oregon	60.4	0.0	Beulah	102	23	Silverlake	22	17	0.72	−0.81	Bay City	3.83	Several stations	0.00
						Bend		21						
Pennsylvania	66.0	−2.7	York	97	12	Wellsboro	32	9	5.97	+2.43	Mauch Chunk	8.93	Lock No. 4	3.35
Porto Rico	79.4	0.0	Morovis	98	4	Adjuntas	55	9	16.12	+4.66	Perla	33.30	Arecibo	4.60
South Carolina	78.5	+0.6	Liberty	105	12	Santuc	52	10	4.48	−0.38	Trenton	8.11	Cheraw	1.39
South Dakota	62.6	−5.0	Hotch City, Rosebud	103	9	Ashcroft	24	20	3.13	−0.19	Howard	6.87	Spearfish	1.08
Tennessee	75.3	+0.1	Tracy City	107	12	Erasmus	38	23	4.52	+0.18	Silverlake	10.08	Chattanooga	1.33
Texas	83.0	+2.6	Cotulla	116	28	Tulia	43	21	1.96	−1.80	Nacogdoches	14.22	8 stations	0.00
Utah	66.9	+1.5	St. George	114	20-22	Loa	21	1	0.17	−0.19	Meadowville	0.90	11 stations	0.00
Virginia	71.4	−1.1	Bedford City	102	10	Burkes Garden	34	9, 23	3.81	−0.23	Bigstone Gap	7.15	Cliftonforge	1.15
Washington	59.3	−0.7	Pasco	101	8	Republic	27	6	1.01	−0.67	Clearwater	5.17	3 stations	0.00
West Virginia	68.0	−2.5	Logan	100	12	Terra Alto	33	9	5.19	+1.34	Powellton	8.49	Rippon	2.45
Wisconsin	61.9	−4.6	Koepenick	94	13	Butternut, Koepenick	29	23	3.97	−0.30	Darlington	8.50	Wausaukee	1.54
Wyoming	60.1	+0.2	Basin	103	9	South Pass City	11	3	1.44	−0.14	Chugwater	4.43	Basin	0.24

South Carolina.—Over all but the extreme eastern, northeastern, and extreme western portions, the rainfall was ample, at a few points excessive. The weather was, on the whole, favorable for harvesting and thrashing wheat and oats, except that some oats in the shock were slightly damaged by rain. Tobacco curing was begun about the middle of the month, but made slow progress. Corn and cotton prospects were the best in many years. Peaches and melons ripened and were largely marketed, the former a moderate and the latter a large crop.—*J. W. Bauer.*

South Dakota.—The weather conditions were favorable for spring wheat, oats, barley, rye, spelt, and grasses. Cool weather, however, kept corn backward. On the 21st heavy frost over large areas seriously injured and set back many fields of corn and potatoes, but subsequent favorable weather improved their condition. Some fruit, flax, and early barley were also injured by the frost. A severe straight gale occurred in the evening and night of the 24th over portions of Bon Homme, Clay, Hand, Hutchinson, Lincoln, Turner, Union, and Yankton counties, causing heavy loss in barns and other farm out-buildings, trees, and windmills, and damaging some farm dwellings and also some business and other houses in several small towns. One person was killed and several were injured. The gale also damaged tree fruits, lodged considerable small grain, and temporarily injured some corn. The month closed with the outlook for small grains very gratifying and the prospect for a fine crop of hay excellent.—*S. W. Glenn.*

Tennessee.—The rainfall was deficient during most of the month, except in scattered sections, where heavy local rains fell; good rains came near the close of the month. Vegetable crops, mostly in the middle section, were the chief sufferers from lack of moisture; corn, cotton, and tobacco made excellent progress during the entire month. The weathe was generally favorable during the harvesting season. The wheat yield was poor in quantity, but the quality of the grain was generally very good. At the close of the month apples were scarce and peaches promised a short crop.—*Roscoe Nunn.*

Texas.—The weather was unfavorable for the growth of vegetation throughout the greater portion of the State until the last decade of the month, owing to high temperatures and hot, drying, southerly winds. The heavy and widely spread rains, the result of the Gulf storm from the 26th to 28th, materially changed conditions and caused a rapid and marked improvement in all crops that were not too far gone to be benefited. There were small areas over the northwestern and southwestern portions of the State and along the Rio Grande Valley where little or no rain fell, and in these sections the droughty conditions that had continued during the previous month were becoming serious. At the close of the month a decided improvement was noted in cotton, which began opening in southern counties and picking was begun, the first bale of the season having been ginned on the 28th. Little damage from boll weevil or other insect pests was reported. Corn continued to deteriorate and when the rain came many fields of the early planted were too far gone to be benefited and a considerable acreage was cut for forage; late planted corn was greatly revived by the rains and at the close of the month was generally promising. Rice showed a marked improvement after the heavy rains, which furnished ample water for irrigation. Trucking interests suffered severely during the drought and the season for some of the early vegetables was shortened from one to three weeks.—*Edward H. Bowie.*

Utah.—Unusually warm weather prevailed from the 8th to 13th and from the 21st to 24th. Light frost occurred in elevated regions of the State on the 2d and 3d, and of the northern counties on the 18th. Potato vines and tender plants were nipped, but no serious damage done. With the exception of the north-central part of the State, the rainfall was too light to be beneficial. Dry land wheat was badly damaged by drought, and over the greater portion of the State will be a failure, or nearly so. The ranges are in poor condition. Irrigated crops did well.—*L. H. Murdoch.*

Virginia.—The month was not favorable for crop growth. Beginning with the 1st and continuing with but few interruptions until the last decade the weather was cool and entirely too dry for crops to make seasonable advance. Light frosts occurred on various dates, both early in the month and again between the 21st and 23d doing some slight damage.—*Edward A. Evans.*

Washington.—The month was cool and dry, not favorable for the best growth of crops. Frost on the 5th was heavy in some localities of the eastern section and injured tender vegetables. During the third week of the month hot weather and drying winds caused some injury to wheat, particularly spring sown wheat, on light soils and clay patches. Potatoes were slightly set back by the dry spell.—*G. N. Salisbury.*

West Virginia.—June was an unusually cool month. Frosts were recorded in high altitudes on the 9th and 24th. The low temperatures had rather an injurious effect in retarding the growth of corn, but the condition of all other crops was generally improved. Heavy showers during the fourth week were generally unfavorable for harvesting. At the close of the month wheat and clover harvesting were in progress with about half yields; oats were heading, and a fair crop was expected; meadows were improving, but a light crop was anticipated; potatoes and garden truck were growing nicely; apples and peaches fell considerably during the month, and the prospect was for half a crop.—*E. C. Vose.*

Wisconsin.—Weather conditions were mainly favorable for crops. Frequent showers prevented proper cultivation of corn, but other crops made remarkably rapid growth. Pastures exceptionally good and stock excellent. Apples deteriorated, but small fruits generally satisfactory.—*J. W. Schaeffer.*

Wyoming.—Continued dry weather till the 28th of the month caused ranges to dry and burn in many sections of the State, but good rains after the 28th revived the growth of the grass, and gave good prospect for fall and winter feed, as well as increasing the prospect for a hay crop. Irrigated crops made favorable growth, and first crop alfalfa was usually up to, and in some sections exceeded, the average. Frosts did some damage to tender vegetation.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

HANN'S METEOROLOGY.[1]

By Prof. Frank H. Bigelow.

This great work by the well known Austrian meteorologist, Dr. Hann, whose name is a guarantee for its high scientific value, is handsomely printed on large quarto pages in three kinds of type; the first covering the main course of the thought, the second many important scientific comments and references, the third an exceedingly rich bibliography of meteorology and some mathematical developments. It is well executed throughout, is very free from typographical errors, contains many fine plates of phenomena, numerous drawings, a complete index and table of contents. The book is intended to describe the state of meteorology at the end of the nineteenth century, and this large task could hardly have been performed by any one in a more satisfactory manner. The amount of labor required to digest the mass of literature which has been produced in the past thirty or forty years, since the appearance of Dr. E. E. Schmid's Lehrbuch of 1860, will be realized with difficulty by a non-professional reader, but it is a surprise to see how little has escaped Dr. Hann's attention, judging at least by his generous and frequent references to the work of American meteorologists, and especially of the United States Weather Bureau. It has evidently been his intention to bring forward all the important facts that may be regarded as in anywise beyond the range of speculation and controversy, and each department of meteorology is very fully exploited. At the same time every reader will be impressed with the conservative and judicial tone of the writing, so that it may be said that a safe book has been put into the hands of students who are engaged in this field of science. It will be gratifying to the meteorologists of the Weather Bureau to find the views they have advocated during the past ten years almost without exception in accord with the conclusions adopted by Dr. Hann. This makes us feel that meteorology is at last taking root in firm ground, and that its healthy growth is now assured.

The first impression regarding this work is that the book is a very large one to read, and yet, even its present size is obtained only by omitting entirely to treat such important topics as methods of forecasting, weather periods, numerous mathematical papers of physicists discussing the more purely dynamic problems, and the development of the equations of motion together with their application to the problems of atmospheric circulation. Moreover, as one reads, there is nothing superfluous even for a professional student, and any omission would be a distinct loss to the subject; especially would one be sorry to have had the bibliography reduced to any extent. The treatment is rich in two special lines: (1) in the periodic variations of all the atmospheric elements, and (2) in the physics of static meteorology as distinct from dynamic meteorology. Such important mathematical problems as development in series, the thermodynamic relations in vertical and horizontal directions, and the barometry of the atmosphere, are suitably discussed with much clearness in the appendix, so that every student will find himself much assisted by reading Hann's treatment of these topics.

There are a number of theories, regarding the scientific truth of which doubt has existed, and it may therefore be proper to state briefly Dr. Hann's adopted views regarding them, without any discussion, since the opinions of such a master of meteorology deserve to carry much weight with them. I shall pass over many items of interest for the sake of briefly mentioning subjects of the character just indicated. The permanent gas constituents of the air, oxygen, nitrogen, carbonic dioxide, argon, helion, krypton, metargon and neon, are mixed according to Dalton's law in the lower strata, but in the same percentages in the highest strata explored, this being caused by the circulation of the atmosphere. The nuclei of condensation of aqueous vapor are ions as well as particles of dust; but the vapor is distributed by a law different from Dalton's. The solar constant may be taken as 3 gram calories, though possibly it should be advanced toward 4, but not beyond. The minimum temperature of the sun is not far from 7,000° C. The natural period of solar insolation has one maximum about 1 or 2 p. m., and one minimum about 4 or 5 a. m., but this is often converted into a double period by disturbances caused by vertical convection during the afternoon, the double period appearing in the diurnal pressure, electric potential, and vapor tension of the atmosphere. Stefan's law of the intensity of radiation $J_o = 0.723 \times 10^{-10} T^4$, where T is the absolute temperature, is applicable throughout space, except as modified by the solar or planetary atmospheres. All short series of observations should be carefully reduced to the corresponding long series by suitable corrections. There is no evidence that climates have changed since the beginning of accurate observations. The old series of balloon observations by Glaisher is not comparable with those derived from modern instruments. The boiling point of water method is not available for the accurate determination of altitudes and variations of gravity, on account of the narrow range of temperature

[1] Lehrbuch der Meteorologie, von Dr. Julius Hann, Professor an der Universität zu Wien, mit 111 Abbildungen im Text, 8 Tafeln in Lichtdruck und Autotypie, sowie 15 Karten. Vorwort und Zeichniss XIV pp. Text 805 pp. 4to. Leipzig, 1901. Chr. Herm. Tauchnitz.

available for the exact observation. The secular variations of pressure are accompanied by a flow of air from one hemisphere to the other and back again. The diurnal variation of the barometer still remains a difficult problem, but there is some evidence of its being a wave swinging through the air in forced vibrations, such as Lord Kelvin suggested. Hutton's theory of condensation of vapors mixed at different temperatures is applicable to the formation of clouds but not to rainfall. A reliable self-registering psychrometer is greatly needed in practical meteorology. The measures of rainfall ought to be reduced to a scientific scale in all cases.

The Espy-Köppen theory of the diurnal variation of the wind velocity in different strata is satisfactory. The relative amount of solar radiation absorbed in the upper and the lower atmosphere is an important problem only partially worked out. The deflecting and centrifugal forces expend no energy on the movement of masses of air, but change only the direction of their motion and not the velocity. The vertical thickness of the land and sea breezes, the mountain and valley breezes, and the monsoon and trade winds ought to be carefully determined in different localities. Some doubt is expressed regarding the completeness of the canal theory of the general circulation of the atmosphere between the equator and the poles, but the scheme of Ferrel is approved in general. The vertical convectional theory of the origin of cyclones is vigorously rejected and the horizontal convection theory is favored. The action of countercurrents of air is distinctly illustrated in the formation of tornadoes and waterspouts, tropical hurricanes and extratropical cyclones; the origin and direction of two independent component streams of air are plainly described. The general equation of equilibrium in terms of gradient, deflecting and centrifugal forces is clearly deduced and its meaning carefully illustrated. A good historical description is given of the first weather charts and the earliest synoptic daily maps. The deflection angle seems to be preferred to the inclination angle for the purpose of analyzing the relation of the wind direction to the gradient. It is shown that V-shaped depressions are characteristic of the Southern Hemisphere, with counter winds on each side, while cyclonic gyrations are but further developments of the same phenomenon, and are more commonly found in the Northern Hemisphere. Summer hot waves are explained as stagnant masses of air, in which heat gradually accumulates at the ground and then increases upward to great heights. The foehn wind effect is due to dynamic heating of the air descending from the crest of a mountain range to the valley. The bora is due to masses of air of different temperatures lying close together without mixing, and then pushing forward as a whole, as over a coast line. The types of American weather have not been sufficiently developed and published. A strong and even abnormal vertical temperature gradient accompanies the formation of thunderstorms, which are attended by an inversion of the overlying strata. The squall in thunderstorms is a horizontal roll at the front. The formation of hail seems to be due to a tornado tube or vertical whirl in the upper strata of the cloud, and Ferrel's orbit theory for the formation of the successive layers of ice and snow in the hailstone is regarded with favor. The secular variation of nearly all the meteorological elements in the 11-year and the 35-year solar periods is admitted, but these researches are not yet in a conclusive or satisfactory state of development. The stratification of the atmosphere with currents of different temperatures, especially where abnormally cold air overlays excessively warm strata, and the consequences of such unstable conditions of equilibrium are well depicted. The theory of the cause of the atmospheric electric potential fall that seems most promising is the ionization theory of gases which is briefly described.

Finally, I shall venture to remark that it is likely that further consideration, and the accumulation of suitable observations, will probably tend to modify Dr. Hann's views regarding the canal theory of the general circulation, and especially as regards Ferrel's idea of the westward flow at the north pole, and the triple stratification of currents on the polar side of the trade wind zones; the cause of the double diurnal barometric wave is still open to discussion; also there are very serious objections against accepting Ferrel's theory of the orbital motion of hailstones in the neighborhood of a tornado tube in the upper strata of a thunderstorm cloud. On pages 272, 273, 275 it is stated that in the Weather Bureau observations of 1896-97 certain cloud heights were measured by nephoscopes. The fact is that all the cloud heights were determined by the theodolite, and then certain mean heights were adopted to carry forward the discussion of the nephoscope observations.

Dr. Hann deserves the thanks and will receive the congratulations of all meteorologists for his able, useful, and satisfactory work. It is a book that should be translated into English and placed in the libraries of all colleges, in library reference rooms, and in the hands of those students who intend to take up the subject seriously. It will give a strong impetus to sound learning in this branch of science, and it is a worthy companion to Dr. Hann's well known "Klimatologie."

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Meteorologische Zeitschrift. Wien. Band 19.

Paulsen, A. Vorläufige Mittheilungen über einige Arbeiten der Dänischen Expedition in Utsjoki. Pp. 276-279.

Ekholm, Nils. Ueber die Höhe der homogenen Atmosphäre und die Masse der Atmosphäre. Pp. 249-260.

—— Täglicher Gang des Luftdruckes und der Temperatur zu San José de Costa Rica. Pp. 273-274.

Krebs, W. Neue Sonnenringbeobachtung. P. 275.

—— Klima von Potsdam. Pp. 275-276.

Exner, Felix M. Ueber den Gleichgewichtszustand eines schweren Gases. Pp. 278-279.

—— Das Weather Bureau. P. 279.

—— Physiologische Wirkung des verdünnten Luftdrucks. Pp. 279-280.

—— Verdunstung zu Camden Square, London. P. 281.

—— Grosser Regenfall in England am 12 Juli 1900. Pp. 280-281.

—— Zur Meteorologischen Optik. P. 282.

Benndorf, H. Ueber ein Mechanisch registrirendes Elektrometer für luftelektrische Messungen. Pp. 282-283.

Birkeland, Kr. Norwegische Erdmagnetische Expedition 1902-1903. Pp. 283-284.

—— Das Darmer'sche Quecksilberbarometer. Pp. 284-285.

—— Klima von Pemba, Ostafrika. P. 285.

—— Galvanometrische Beobachtung ferner Gewitter. Pp. 285-286.

—— Meteorologische Beobachtungen im (sog.) arktischen Nordamerika. P. 286.

—— Gewitter und Mondphasen. P. 289.

Schwarz, L. St. Elmsfeuer auf der Schneekoppe. Pp. 289-290.

Weitlaner, Franz. Einzelne Sonnenuntergangs-und Dämmerungsformen in subtropischen und tropischen Gebieten. Pp. 290-292.

—— Deutsche Meteorologische Gesellschaft. Jahresbericht und Rechnungsablage für 1901. Pp. 270-271.

Hann, Julius. W. v. Bezold: Ueber klimatologische Mittelwerthe für ganze Breitekreise. Pp. 260-263.

Hann, Julius Teisserenc de Bort über die Temperaturabnahme mit der Höhe. Pp. 272-273.

Hann, Julius. Anschliessende Bemerkungen über die Mittelwerthe der meteorologischen Elemente für die Ganze Erdoberfläche. Pp. 263-269.

Hann, Julius. Die Temperatur des Mai in Wien. Pp. 271-272.

Hann, Julius. Interdiurne Temperaturveränderlichkeit in Mexiko. P. 281.

—— Maikälte in England. P. 272.
—— Tintenregen in Paris. P. 272.
Hann, Julius. Resultate der meteorologischen Beobachtungen am Observatorium zu Rousdon (England) 1884–1900. P. 286–288.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 134.
Eginitis, D. Sur une perturbation magnétique, observée à Athènes le 8 mai 1902. Pp. 1425–1426.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 135.
Viguier, C. Influence de la température sur le développement parthénogénétique. Pp. 60–62.

Annalen der Hydrographie und Maritimen Meteorologie. Berlin. 1902.
Reinicke. Temperaturwerthe und Niederschlagsmengen zu Neufahrwasser in den Jahren 1876 bis 1900. Pp. 334–336.
Hr. Der Bora-sturm im nördlichen Adriatischen Meere am 31. Januar und 1 Februar 1902. Pp. 327–331.

L'Aérophile. Paris. 10me Année.
Canovetti, C. Études sur la résistance de l'air. Pp. 140–144.
Grégoire, Pierre J. Aviateur à ailes battantes. Pp. 134–140.

Ciel et Terre. Bruxelles. 22me Année.
Very, F. W. Un cycle cosmique. Pp. 216–224.
P., W. L'éruption de la montagne Pelée, à la Martinique. Pp. 207–209.

Archives des Sciences Physiques et Naturelles. Genève. 107me année. 4me Période. Tome 13.
Gautier, R. Observations météorologiques faites aux fortifications de Saint-Maurice pendant l'année 1901. Pp. 581–595.

Annuaire de la Société Météorologique de France. Paris. 50me Année.
Poincaré, A. Combinaison des effets barométriques de la révolution synodique et de la rotation terrestre sur l'ensemble du globe. Pp. 96–102.

Journal New York Botanical Garden. New York. Vol. 3.
MacDougal, D. T. Effect of Lightning on Trees. Pp. 131–135.
MacDougal, D. T. The Temperature of the Soil. Pp. 125–131.

Das Wetter. Berlin. 19 Jahrgang.
Polis, P. Wetterdienst am Meteorologischen Observatorium zu Aachen. Pp. 141–143.
Assmann, Richard. Die örtlichen Bedingungen für die Anlage einer Drachenstation. Pp. 121–130.
Grohmann, —. Die klimatischen Verhältnisse des Königreiches Sachsen in ihrer Abhängigkeit von Luftdruck und Windursprung. Pp. 130–140.

Zeitschrift für Gewasserkunde. Leipzig. 5 Band.
Gravelius, H. Zur Kenntniss der Seiches des Eriesees. Pp. 43–51.
Halbfass, Wilhelm. Stehende Seespiegelschwankungen (Seiches) im Madüsee in Pommern. Pp. 15–38.

Geographical Journal. London. Vol. 20.
André, E. The Volcanic Eruption at St. Vincent. Pp. 60–68.
Dickson, H. N. The Eruptions in Martinique and St. Vincent. Pp. 49–60.
—— The Atmosphere in the Neighborhood of Vesuvius. [Note on paper by G. Melander.] P. 100.

Electrical World and Engineer. New York. Vol. 40.
Gore, J. W. Wireless Telegraphy, an Electrostatic Effect? Pp. 51–52.
Marconi, —. Wireless Telegraphy. Pp. 49–51.

Scottish Geographical Magazine. Edinburg. Vol. 18.
—— The Climate of Edinburg. Pp. 349–353.

Science. New York. Vol. 15.
Baskerville, Charles, and Weller, H. R. Black Rain in North Carolina. P. 1034.

Science. New York. Vol. 16.
Barus, C. On a Method of Hygrometry. Pp. 33–34.
Ward, R. DeC. Iridescent Clouds. Pp. 32–33.

Memoria de Societa "Antonio Alzate." Mexico. Tome 16.
Moreno y Anda, M. La meteorologia y las predicciones del calendario de Galvin. Pp. 229–237.
Puga, Guillermo B. Consideraciones sobre la distribucion general de las lluvias y en particular en la Republica Mexicana. Pp. 137–156.

Gaea. Leipzig. 38 Jahrgang.
—— Die vulkanischen Eruptionen auf Martinique und St. Vincent. Pp. 449–466.
—— **M. u. S.** Einfluss von Schiessübungen auf die Gewitterthätigkeit. Pp. 466–468.
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Witte, E. Zur Theorie der Stromkabbelungen. Pp. 484–487.
—— Ueber die Meteorologie des Aequators. [Note on article by J. Hann.] Pp. 502–503.

Scientific American. New York. Vol. 87.
—— Photography of Sound Waves. P. 34.
—— A Peculiar Lightning-Shattered Tree. P. 41.

Illustrirte Aeronautische Mittheilungen. Heft 3. 1902.
Martienssen, O. Theoretische Grundlage für die Construction eines Schraubenfliegers. Pp. 125–133.
Kutta, W. M. Auftriebskräfte in strömenden Flüssigkeiten. Pp. 133–135.

Bulletin of the American Geographical Society. New York. Vol. 34.
Ward, Robert DeC. The Agricultural Possibilities of Alaska. [Note on The Possibilities of Alaska, and Agriculture in Alaska, in National Geographical Magazine.] Pp. 239–240.
Ward, Robert DeC. The Mexican Belt of Calms. [Note of James Page on the Pilot Chart of the North Pacific Ocean for April.] Pp. 241–242.
Ward, Robert DeC. Loss of Life in the United States by Lightning. [Notes on Bulletin No. 30, Weather Bureau, Loss of Life in the United States by Lightninng.] Pp. 238–239.
Ward, Robert DeC. Climate of Western Australia. [Notes on The Climate of Western Australia issued from Perth (W. A.) Observatory.] Pp. 240–241.
Ward, Robert DeC. Some Physiological Effects of Sunshine and Shade. [Abstract of Quelques Mots sur le Groupement de la Population du Valais, by M. Lugeon (Etrennes Helvétiques pour 1902)]. P. 241.

Philosophical Magazine. London. 6th series. Vol. 4.
Trowbridge, John. On Spectra arising from the Dissociation of Water Vapour and the Presence of Dark Lines in Gaseous Spectra. Pp. 156–161.
Barus, C. The Sizes of the Water Particles producing the Coronal and the Axial Colours of Cloudy Condensation. Pp. 24–29.

Aeronautical Journal. London. Vol. 6.
—— The Variation of Temperature with Height. [Abstract of article in Nature by N. Shaw.] P. 50.
—— The Measurement of Electricity in the Air from Balloons. Pp. 47–48.
—— The Ballon-Sondes Experiments. P. 48.
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—— The Physiology of Ascents. P. 47.
Bacon, J. M. Scientific Observations at High Altitudes. Pp. 40–43.
—— The Recent High Balloon Ascent of Dr. Süring and Dr. Berson. Pp. 46–47.

Nature. London. Vol. 66.
Chree, C. Arctic Magnetic Observations. Pp. 227–228.
Porter, T. C. The Halos of May 1, 8, and 22. P. 223.
Clark, J. Edmund. The Coloured Sunsets. P. 223.
Lockyer, William J. S. The Coloured Sunsets. Pp. 222–223.
Krohn, F. W. T. Remarkable Sunsets at Madeira. P. 199.
Sutton, J. R. Cold Weather in South Africa. P. 247.
Lockyer, William J. S. and Norman (Sir). A Short Period of Solar and Meteorological Changes. Pp. 248–249.
—— Apparent Deformation of the Sun's Disc near the Horizon. P. 259.
—— Oceanographical Investigations in South African waters. P. 260.

Boletin Sociedad Geográfica. Lima. Año 11. Tomo 11.
Valdizan, Dario. Observaciones termométricas tomadas en el campamento "El Mirador," provincia de Chincha, de mayo á julio de 1901. Pp. 417–420.
—— Temperatura diaria tomada á la sombra en la Hacienda Chiquitoy (valle de Chicama), en los años de 1900 y 1901. Pp. 415–417.
Jones, H. Hope. Observaciones tomadas en San Ignacio, Cailloma, de agosto á diciembre de 1901. Pp. 412–414.
Aguayo, Francisco B. Disertacion sobre la temperatura de Lima. Pp. 367–393.

Annalen der Physik. Leipzig. 4 ser. Band 8.
Stark, J. Einfluss der Temperatur auf die Ionisirung durch Ionenstoss. Pp. 829–841.
Stark, J. Der Ionenstoss als Ionisator in neueren Versuchen. Pp. 815–828.

Symons's Meteorological Magazine. London. Vol. 37.
Ellis, W. The Moon and Rainfall. [Note on Mr. MacDowall's communication to Symons's Met. Mag. London. November, 1901.] Pp. 85–87.

Journal de Physique. Paris. Tome 1.
Sagnac, G. Chr. Jensen. Kurzer Ueberblick über die Thatsachen und Theorien auf dem Gebiete der atmosphärischen Polarisation (Court aperçu sur les faits et théories relatifs à la polarisation atmosphérique). Pp. 448–449.

Proceedings of the Royal Society of London. London. Vol. 70.
Cullom, J. E. Report of Absolute Magnetic Observations at the Valencia Observatory (Cahirciveen, County Kerry), 1899, 1900 and 1901. P. 246–249.

Journal of the Franklin Institute. Philadelphia.
Keller, H. F. The Gases of the Atmosphere. Pp. 47–57.

Popular Science Monthly. New York. Vol. 61.
Jaggar, Thomas Augustus. Field Notes of a Geologist in Martinique and St. Vincent. Pp. 352–368.

Memorie della Societa degli Spettroscopisti Italiani. Catania. Vol. 31.
Boccara, Vittorio E. Sulle Variazioni Diurne Della Rifrazione Atmosferica. (Secondo Contributo). Pp. 89–97.

Physical Review. Lancaster. Vol. 15.

Knipp, Charles T. Method of Maintaining Intermediate Temperatures. P. 125-126.

American Journal of Science. New Haven. 4th ser. Vol. 14.

Trowbridge, J. Spectra Arising from the Dissociation of Water Vapor and the Presence of Dark Lines in these Spectra. Pp. 1-7.

GROUND TEMPERATURE OBSERVATIONS AT ST. IGNATIUS COLLEGE, CLEVELAND, OHIO.

By Dr. LYMAN J. BRIGGS, Bureau of Soils.

In the report of the Meteorological Observatory of St. Ignatius College, Cleveland, Ohio, 1900-1901, Rev. F. L. Odenbach, S. J., publishes a series of observations on ground temperatures made at a depth of 4 feet. The observations cover a period from 1897 to 1901. The monthly and yearly mean for each year during this period is given, and the daily temperatures during the months of February, May, and August, 1900, are also published. The following excerpt from the report of the observatory gives the method of making the determinations:

> The data subjoined were gathered from a thermometer placed 4 feet below the surface of the ground. Great care was taken to insulate it from solar radiation and atmospheric temperature. For this purpose a 2-inch steel pipe was sunk into the ground, the lower end reaching 4 feet below the surface. The top end projects through the bottom of, and 4 inches into, an earthenware jar. This projecting part within the jar is capped with a movable cover made of 2.5-inch steel pipe. The jar, in turn, is covered with a lid of earthenware and the whole, which stands even with the ground surface, is covered with a wooden drum. The thermometer, which rests at the bottom of the 4-foot shaft, may be pulled up by a chain after the three covers have been removed. It is encased in a wooden tube, exposing only the grading of the mercury column; while its bulb has been insulated by a mixture of asbestos and carbonate of magnesium, held around it by a perforated brass cup. With all these precautional appliances, we are certain of getting a real ground temperature. The circulation within the tube might seem to create some difficulty, but it was supposed that the warmer air toward the surface would not descend, but that it would lose its temperature where it was, by the conductivity of the steel pipe which extended downward into colder regions. The insulation of the bulb is so perfect that it may be exposed to the direct rays of the sun for almost half a minute before it shows signs of rising; it may therefore be read with leisure and without fear of its having been influenced by the temperature existing above ground. Because it is not subject to diurnal variations, it has been read at 8 a. m., seventy-fifth meridian time, daily; this being the time at which all other observations are taken.

We regret that we can not agree with Odenbach in his conclusion that his observations represent the true ground temperature at a depth of 4 feet. It will be noted that a 2-inch steel pipe extends from near the surface of the ground to a depth of 4 feet, and that the thermometer with which the observations were made was placed inside of this pipe. The bulb of the thermometer was not embeded in the soil, but was simply suspended at the base of the shaft, or with its asbestos insolation resting upon the bottom of the shaft. The temperature recorded therefore was not the temperature of the soil, but rather that of the air in the bottom of the shaft. No provision whatever was apparently made to prevent air-convection currents in the steel tube, so that the thermometer really records the temperature of the convection currents at the bottom of the shaft. During the summer months when the temperature at a depth of 4 feet is lower than the temperature nearer the surface, the error introduced from this source would probably not be great, but during the winter months when the surface stratum of soil is cooler, the cooler air in the upper portion of the tube would continually settle towards the bottom of the shaft, and the thermometer would record temperatures lower than the actual temperature of the soil at a depth of 4 feet.

Another feature leading to erroneous results is the steel tube extending from the bottom to the top of the shaft. Steel being so much better a conductor than the soil, would, during the warmer months, readily conduct the heat down from the surface stratum and so raise the temperature of the lower portion of the shaft. In winter also, the temperature of the lower part of the shaft would by this means be reduced below the true temperature of the soil at that depth.

In the opinion of the reviewer a far more satisfactory and reliable method of investigating ground temperatures at a considerable depth below the surface is to be found in some form of electrical thermometer. An insulated coil can be buried at the desired depth and allowed to remain undisturbed throughout the whole period of investigation of temperature; the presence of all heat-conducting material other than the soil is limited to the two small wires forming the terminals of the resistance coil. This method is employed in the temperature observations now being carried on at the Radcliffe Observatory,[1] Oxford, where platinum resistance thermometers of the well known Callendar and Griffiths pattern are used. Attention should also be called to the method of reducing the observations at Oxford, first employed by Thomson,[2] which gives not only the temperature but important data regarding the thermal conductivity of the soil as well. The observations are first grouped into monthly means, and harmonic expressions are then deduced which will represent the readings of each thermometer throughout the year. From each wave as observed at any pair of thermometers two determinations of the thermal conductivity of the gravel may be obtained, one from the diminution of the amplitude of the wave and the other from the retardation of phase.

UNSEASONABLE WEATHER IN THE UNITED STATES.

By Prof. E. B. GARRIOTT, Weather Bureau, dated July 31, 1902.

The cause of unseasonable weather is not demonstrable. Neither is it possible in all cases to determine which of the general atmospheric conditions that are associated with unseasonable weather partake of the nature of cause and which of effect.

It has been observed that summer periods of low temperature are associated with barometric pressure below the normal and abundant rainfall, and that summer periods of excessive heat are associated with barometric pressure about or above the normal and a marked deficiency in rainfall. It has also been observed that winter periods of excessive cold are associated with barometric pressure above the normal and little or no precipitation, and that periods of high temperature in winter are associated with barometric pressure below the normal and rain or snow. It has been observed further that the general atmospheric conditions referred to are associated with areas of high and low barometric pressure that traverse the United States. In summer the atmosphere over regions subjected to unusual cold and abnormally heavy rainfall is dominated by areas of low barometric pressure, or general storms, that follow unusual tracks for the season, and the atmosphere over regions subjected to unusual heat is undisturbed by the passage of general storms, and is dominated by an extensive and almost stationary area of high barometric pressure. In winter periods of excessive cold are experienced in connection with areas of high barometric pressure of great magnitude that advance from the British Northwest Territory, and also in connection with general storms that follow abnormal southerly paths, and periods of unusually warm weather occur in connection with a succession of general storms that pursue abnormal northerly paths.

A study of the daily meteorological charts of the Northern Hemisphere shows that the general atmospheric conditions over the United States that are associated with unseasonable weather in any part of the country are, in turn, associated with atmospheric conditions that obtain over at least a great part of the Northern Hemisphere. The international charts

[1] Proceedings Royal Society, 67, p. 218, 1900.

[2] Transactions Royal Society, Edinburg, 22, p. 409, 1861.

show that when a period of abnormal weather prevails over a considerable area of the United States, there is a disarrangement of the normal distribution of atmospheric pressure over a great part of the Northern Hemisphere. They show that in the presence of unseasonable weather in any part of the Northern Hemisphere the so-called permanent continental and oceanic areas of high and low barometric pressure present abnormal aspects, and there is an interruption in the normal succession and progression of the areas of high and low barometric pressure of the middle latitudes.

Admitting the possibility of a primary cause of unseasonable weather that first affects the earth's atmosphere as a whole, by disarranging the normal distribution of atmospheric pressure and finally interrupts the usual succession over the continents and oceans of areas of high barometer and general storms, there is presented a fascinating field for speculation and study. Speculation regarding the nature of the cause would naturally be directed toward supposed evidence of solar disturbances as indicated by sun spots, to manifestations of the electro-magnetic influence of the sun's radiant energy, or perhaps to planetary or other equally obscure and possibly imaginary influences. Study should begin with facts presented at the surface of the earth. In the outline of these facts the association of periods of unseasonable weather with local, continental, and hemispherical barometric pressure has been shown.

A study of international meteorological reports conducted with a due regard for the facts referred to would be calculated to lead to a determination of the relation between changes and movements in the smaller and the greater barometric areas, and to an association of changes in the greater barometric areas with some cause that is external to the earth's atmosphere. It is possible also that study carried along these lines would lead to the discovery that periods of unseasonable weather in any part of the Northern Hemisphere are preceded days and perhaps weeks by certain changes in the hemispherical system of barometric pressure, and that all changes and conditions that are observed in our atmosphere, and that all kinds and types of weather that we experience are subject to definable laws of causation.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see page 340.]

Notes on the weather.—On the Pacific slope the rainfall was abundant and of daily occurrence until the 22d, after which there was a marked interruption, corresponding to the so-called veranills de San Juan. On the whole, the total amount at most stations was below the normal. At San Jose the pressure was generally below the normal, the lowest observed (660.6 mm. at 4 p. m. on the 1st and 2d) being the absolute minimum since 1888. The temperature was slightly above normal. On the Atlantic slope the rainfall was about normal, but there was a general complaint about the heat. Electric storms, with abundant showers, have been reported from several stations.

Notes on earthquakes.—June 12, $11^h 04^m$ p. m., slight shock, NNW-SSE, duration 12 seconds, intensity II. June 14, $5^h 40^m$ p. m., slight shock, E-W, duration 3 seconds, intensity II. June 20, $5^h 45^m$ p. m., slight shock, E-W, duration 7 seconds, intensity II. June 26, $0^h 29^m$ a. m., sensible tremors, E-W, generally felt, duration 12 seconds, intensity III.

A WATERSPOUT AT CLOSE RANGE.[1]

By Dr. O. L. FASSIG, Section Director.

Although the mechanism and mode of occurrence of waterspouts are now fairly well understood, descriptions of these erratic phenomena are always interesting and instructive when coming from an eye witness. It is still a rare occurrence to meet with an intelligent observer who has seen a waterspout at close range. Capt. Fergus Ferguson, of the British steamship *Hestia*, in a recent interview gave a most interesting account of facts that came under his observation while on his way from Baltimore to the Cuban port of Daiquiri. On April 4, toward sunset, while passing off Hatteras, the captain observed several waterspouts in process of formation at a distance of 300 to 400 yards to windward. The largest of these, and the only one completely formed, seemed to be headed directly toward the ship. The captain at first attempted to change his course enough to avoid a collision, but soon discovered that this could not be done. Giving orders for all on deck to go below, he remained until the spout was close upon his ship and then hastily sought a place of safety. A deafening roar was quickly followed by strong wind gusts and a sudden shock as the spout struck amidships and passed over the deck in the direction of the storm. Captain Ferguson reappeared upon deck in time to see two tarpaulins which had covered the hatches, and a plank 8 feet long by 10 inches wide, high up in the air, while his log line with log attached extended straight up into the air to a distance of 40 feet. Beyond the loss of the lighter movable objects on deck and a temporary feeling of apprehension, no harm was done.

When first seen, the waterspout was incomplete. A portion of cloud dipped down from the general cloud level of about 2,000 feet, while at the same time a column of water was apparently rising from the ocean surface just below. At an elevation of between 200 and 300 feet the ascending water column and the descending cloud column met. The diameter of the spout was between 40 and 50 feet, or approximately the width of the *Hestia*. Within the column there was a dark core, almost black, with a diameter of about 2 feet. The captain did not clearly recall evidences of a whirling motion, but a strong upward suction is clearly indicated by the facts noted above. No reference was made to any considerable quantity of water being shipped as the waterspout passed over the vessel, a fact which would indicate that the lower portion of the column was composed mostly of spray formed by the friction of the winds with the surface of the water and carried up by the ascending currents of air.

The weather map for April 4 shows the *Hestia* to have been near the center of a barometric depression which had been moving eastward until the evening of the 4th, when the course was abruptly changed to nearly due north. The local weather conditions are described by third officer W. E. Jenkins in the following report published in the Hydrographic Bulletin for April 23, 1902:

> On the voyage from Baltimore toward Daiquiri, on April 4, 1902, one hour's run south of latitude 35° north, longitude 75° west, observed several waterspouts close at hand, one of which passed over the after end of the ship at 5 p. m. A fresh southwesterly, but unsteady breeze had been blowing; heavy masses of dark thunder clouds hung in the southwest, and the barometer was falling rapidly. The waterspout tore the tarpaulins off the hatches, took everything movable off the deck, and lifted the patent log right up in the air. At 5 p. m., barometer still falling, wind increasing to a fierce gale, with terrific squalls and much vivid lightning and deafening peals of thunder. At 11 p. m., latitude 34° 28′ north, longitude 74° 56′ west, the barometer reached its lowest reading, and the wind suddenly shifted in a fierce squall from southwest, 10, through west to northwest, 8, slightly moderating.

[1] Prepared for the April number of Maryland and Delaware Climate and Crop Report.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

GENERAL SUMMARY FOR JUNE, 1902.

Honolulu.—The water in the artesian well fell during the month from 33.85 to 33.50 feet above mean sea level. June 30, 1901, it stood at 32.85. The average daily mean sea level

for the month was 9.76 feet, 10.00 representing the assumed annual mean. Trade wind days, 14 (2 of north-northeast); normal number for this month, 26. Average force of wind (during daylight), Beaufort scale, 1.5. Cloudiness, in tenths of sky, 3.3; normal, in tenths of sky, 4.0.

Rainfall data for June, 1902.

Stations.	Elevation.	Amount.	Stations.	Elevation.	Amount.
HAWAII.			OAHU—*Continued.*	*Feet.*	*Inches.*
HILO, e. and ne.	*Feet.*	*Inches.*	Makiki Reservoir	120	1.26
Waiakea	50	3.09	U. S. Naval Station, sw	6	1.12
Hilo (town)	100	3.57	Kapiolani Park, sw	10	1.08
Kaumana	1,250	5.25	Manoa (Woodlawn Dairy), e.	285	2.33
Pepeekeo	100	5.09	Manoa (Rhodes)	300	3.93
Hakalau	200	7.40	School street (Bishop), sw	50	1.41
Honohina	300	7.48	Insane Asylum, sw	30	1.76
Puuohua	1,050	12.38	Kalihi-Uka, sw	260	3.04
Laupahoehoe	500	9.75	Nuuanu (W. W. Hall), sw	50	1.75
Ookala	400	4.17	Nuuanu (Luakaha), c	850	4.47
HAMAKUA, ne.			Maunawili, ne	300	8.76
Kukaiau	250	5.99	Ahuimanu, ne	350	5.54
Paauhau (Mill)	300	6.22	Kahuku, n	25	2.44
Honokaa (Muir)	425	6.63	Waialua	20	0.71
Kukuihaele	700	6.86	Ewa Plantation, s	60	1.20
KOHALA, n.			Waipahu, s	200	0.40
Niulii	200	4.47	Moanalua, sw	15	1.24
Kohala (Mission)	521	7.36	Magnetic Observatory	50	3.21
Kohala (Sugar Co.)	235	5.47	KAUAI.		
Puuhue Ranch	1,847	6.73	Lihue (Grove Farm), e	200	1.52
Hawi	600	7.85	Lihue (Molokoa), e	300	2.15
Waimea,	2,720	1.57	Lihue (Kukaua), e	1,000	4.50
KONA, w.			Kealia, e.	15	2.90
Holualoa	1,350	6.54	Kilauea, ne	325	6.76
Kealakekua	1,580	8.23	Hanalei, n	10	7.58
Napoopoo	25	3.50	Waiawa	32	0.15
KAU, se.			Eleele, s	200	0.49
Kahuku Ranch	1,680	1.27	Wahiawa Mountain, s	2,100	8.50
Honuapo	15	1.91	Lawai Mauka	450	1.56
Naalehu	650	2.46	McBryde (Residence)	850	1.85
Hilea	310	1.30	East Lawai	800	1.83
Pahala	850	5.15	West Lawai	200	0.55
PUNA, e.					
Volcano House	4,000	1.75	*Delayed May reports.*		
Olaa, Mountain View	1,700	5.04	Magnetic Station		0.26
Kapoho	110	5.45	Hawi Mill		10.82
MAUI.			Honokaa (Meinecke)		18.44
Waiopae Ranch, s	700	0.86	Honokaa (Muir)		13.45
Kaupo (Mokulau), s	285	1.87	Kula (Erehwon)		0.54
Kipahulu	300	1.86	West Lawai		2.58
Nahiku	850	5.57	East Lawai.		4.35
Nahiku	1,600	10.01	Wahiawa Mountain, s.		18.25
Haiku	700	2.87	Eleele		0.95
Kula (Erehwon)	4,500	6.75	Waiawa		0.34
Puuomalei	1,400	4.70	Paia		3.85
Paia	180	1.44	Kipahulu		5.09
Haleakala Ranch	2.000	4.82	Kapoho		6.82
Wailuku	200	1.31	Nahiku		22.85
Waiakoa	2,700	3.18	Ookala		23.62
OAHU.			Kahuku Ranch		1.36
Punahou (W. B.), sw	47	1.19	Kailua		3.87

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Approximate percentages of district rainfall as compared with normal: South Hilo, 60 per cent; North Hilo, 150; Hamakua, 200; Kohala, 200; Waimea, 115; Kona, 130; Kau, 300; Puna, Olaa region, 50; Puna, Kapoho region, 120; Maui, central, 300; Maui, east coast, 150; Oahu, south, 80; Oahu, north, 150; Kauai, south, 100; Kauai, north, 150.

Mean temperatures: Pepeekeo, Hilo district, 100 feet elevation, mean maximum, 80.6°; mean minimum, 70.6°; Waimea, Hawaii, 2,730 elevation, 79.0° and 64.3°; Kohala, 521 elevation, 81.7° and 69.1°; Nahiku, Maui, 1,600 elevation, 79.1° and 65.5°; Waiakoa, Maui, 2,700 elevation, 80.4° and 61.5°; Ewa Mill, 50 elevation, 84.0° and 69.5°; Magnetic Observatory, 50 elevation, 89.5° and 68.3°; Waikiki Beach, 83.2° and 71.4°.

Mean humidities: Magnetic Observatory, dew-point, 67.6°; relative humidity, 72.0; Ewa Mill, 67.9° and 75; Kohala, Dr. Bond, 68.6° and 82.0.

Heavy surf from the 3d to the 5th, Honolulu; 12th and 29th, Hilo coast, Hawaii. Earthquakes: Hamakua on the 3d at 10 p. m.; Hilo on the 13th at 6:20 a. m. and on the 14th at 3 a. m.; Hamakua and Waimea on the 16th at 4:25 p. m.; Kau has not reported.

The "after glow" and morning glow was very marked throughout the month, being most brilliant about twenty-two minutes after sunset and before sunrise, which would give an elevation of the dust stratum of from 12 to 15 miles, assuming that the most marked coloring would take place at the apparent sunset of that time and elevation. The coloring shaded off from rich yellow to grey green, the daytime corona being whitish grey. There was a recurrence of activity in the central pit crater, Halemaumau, in Kilauea, the breaking upward from below being greatest from the 3d to the 6th. What molten lava there was in the pit was still, however, several hundred feet below the main crater floor and obscured from view by smoke. Many cracks in the main floor, however, revealed heat to the point of redness just below.

There is still a small patch of snow visible on Mauna Kea.

The marked features of the month were, first, the continued low barometer; second, the unusual lack of trade winds; third, the high humidity, altogether making the weather oppressive, although, owing to radiation at night, the average temperature was not excessive.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is 10^h 30^m slow of Greenwich time. Honolulu local mean time is 10^h 31^m slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, June, 1902.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.99	70	65.5	81	71	61.3	63	ne.	3	2	30.05	29.98	0.00
2	29.93	66	63	82	69	63.3	70	e.-sw.	1-0	3	29.99	29.91	0.00
3	29.86	70	68	83	64	62.0	71	sw.	1-0	3-6	29.97	29.89	0.00
4	29.84	72	70.7	83	68	70.0	88	sw.	1-0	3-9	29.89	29.83	0.07
5	29.91	70	69.3	83	71	70.5	83	sw.	2-0	3	29.94	29.84	0.02
6	29.97	72	70	82	69	70.0	83	sw.	1-0	2-9	30.01	29.91	0.00
7	29.95	69	67.7	80	69	70.3	86	s.-sw.	1-0	8-4	30.00	29.95	0.08
8	29.96	68	66.5	82	68	67.0	77	se.-ne.	0-1	5-1	30.00	29.93	0.04
9	29.94	69	67.7	85	67	67.7	76	e.-ne.	1	4-0	30.00	29.90	0.00
10	29.97	69	67.7	83	67	70.0	83	s.-ne.	1-0	5	30.02	29.95	0.00
11	29.98	69	66.5	83	68	68.5	80	se.	1-0	3	30.02	29.96	0.00
12	29.94	69	67.7	85	67	66.3	73	ne.	1	1	30.02	29.93	0.00
13	29.88	73	71	85	67	67.0	72	ne.	1-3	2	29.96	29.86	0.01
14	29.87	71	69	83	68	69.3	80	s.-sw.	2-0	3	29.92	29.86	0.00
15	29.90	71	69.7	83	69	69.3	82	sw.	1	1-4	29.94	29.86	0.04
16	29.92	71	69.7	84	68	69.5	81	sw.	1-0	2-0	29.97	29.90	0.01
17	29.89	73	72	84	70	70.3	85	sw.	1-0	4	29.98	29.89	0.55
18	29.88	71	70.3	84	71	71.0	84	sw.	1-0	4	29.91	29.84	0.09
19	29.93	73	68	82	68	70.0	88	se.-e.	1-0	3-10	29.96	29.89	0.19
20	29.93	73	66.5	80	72	65.0	72	ne.	3-4	3-8	29.98	29.93	0.00
21	29.90	67	65	80	72	63.5	66	nne.	3-4	1	29.95	29.89	0.00
22	29.89	66	64.7	82	65	63.7	72	nne.	3-0	2	29.93	29.86	0.00
23	29.91	73	70	85	65	65.5	74	ne.-nw.	1	1	29.96	29.88	0.00
24	29.96	75	69.5	83	68	68.3	79	ne.	0-3	6-2	29.99	29.93	0.05
25	29.99	75	70.5	82	71	68.5	76	ne.	3-1	6-2	30.02	29.96	0.03
26	29.98	70	68	85	73	67.7	71	ne.	3	3	30.04	29.94	0.00
27	29.96	71	69.3	86	70	68.0	74	ne.	3	1	30.00	29.92	0.00
28	30.01	77	70	85	70	69.5	78	se.-ne.	1-3	4-2	30.04	29.96	0.00
29	30.03	77	69	86	76	67.0	66	ne.	2-4	2	30.07	30.00	0.00
30	30.02	76	69.5	83	76	65.5	65	ne.	5	3	30.07	30.00	0.01
Sums	......	......	......	......	......	......	......	......	......	......	......	......	......
Means	29.936	71.2	68.4	83.2	69.4	67.9	77.7	....	1.5	3.3	29.987	29.912	1.19
Departure	—.061	......	......	......	......	+2.9	+6.7	....	......	—0.7	......	......	—0.33

Mean temperature for June, 1902, (6 + 2 + 9) ÷ 3 = 75.8; normal is 76.0. Mean pressure for June, 1902, (9 + 3) ÷ 2 = 29.950; normal is 30.011.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) ÷ 4. § Beaufort scale.

STUDIES ON THE STATICS AND KINEMATICS OF THE ATMOSPHERE IN THE UNITED STATES.

By Prof. Frank H. Bigelow.

VI. CERTAIN MATHEMATICAL FORMULÆ USEFUL IN METEOROLOGICAL DISCUSSIONS.

THE NEED OF A STANDARD SYSTEM OF FORMULÆ.

There is a large number of mathematical papers that have been written by meteorologists in the exposition of various theories, which must be thoroughly considered by students who seek to go beyond a descriptive statement of the problems into a close examination of the principles upon which the solutions rest. The question arose at an early stage in my study of comparative meteorology as to the form in which such mathematical discussions should be presented to the public. To traverse the entire range of treatises and explain them in detail was clearly impracticable; to adopt an abstract mathematical synopsis, such as is found in Carr's or Laska's synopsis of pure mathematics, was to put too great a strain upon readers who are not specialists in mathematical meteorology. Finally it seemed to me to be a fair compromise to take the following course: (1) reduce the important papers to one common standard notation, and (2) make an analysis of the result in a sufficiently expanded form to enable a good reader to follow the series of equations without difficulty. The only step required to transform the contents of the mathematical compendium as given in chapters 10 and 11 of the International Cloud Report into a complete treatise on analytic meteorology is to supply such transition precepts as are usually placed between the formulæ to aid the thought. It is, however, a distinct advantage for a working use of the formulæ, to one who has once become familiar with such problems, to dispense with these explanatory sentences, which only take up space. A ready reference to the standard equations under each subject is quickly appreciated by any one who uses these formulæ in a practical way, just as one would use a mathematical table in computing. It is my purpose to complete such a collection of formulæ, in addition to the tables contained in my report on Eclipse Meteorology and Allied Problems, Weather Bureau Bulletin I, 1902, by appropriate tables covering the subjects, spherical harmonics, thermodynamics, and the kinetic theory of gases, because these are indispensable in meteorological studies. I have taken the opportunity in this connection to present several original sets of formulæ, which have an advantage in their applications to meteorological problems, and it is my purpose to call attention to some of them in this paper.

THE GENERAL EQUATIONS OF MOTION.

The methods of deriving the general equations of motion on the rotating earth, as presented in Ferrel's paper, "The motions of fluids and solids on the earth's surface," or in the standard treatises of hydrodynamics, are so complicated as to discourage all who are not expert mathematicians from an examination of the solution. The fact that Ferrel did not evaluate the total differential of inertia $\frac{d\,(u,\,v,\,w)}{dt}$, introduced an error into the equations contained in his "Mechanics and general motions of the atmosphere," United States Coast Survey Report, 1875, Appendix 20; this was eliminated in his "Recent advances in meteorology," Annual Report of the Chief Signal Officer, 1885, Appendix 71. There are no doubt many ways of solving this problem, but the following is original, as expanded from Table 75, International Cloud Report, and it leaves little to be desired in respect of simplicity and completeness.

(1) THE POLAR EQUATIONS OF MOTION ON THE ROTATING EARTH.

Using the notation already adopted in Paper II of this series,[1] we write the primary equations of acceleration of motion referred to axes which have their origin at the center of a nonrotating earth, as follows:

The accelerations due to motion and to external forces are:

155.
$$-\frac{1}{\rho}\frac{\partial P}{\partial x}-\frac{\partial V}{\partial x}=\frac{du}{dt}-v\omega_3+w\omega_2$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial y}-\frac{\partial V}{\partial y}=\frac{dv}{dt}-w\omega_1+u\omega_3$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial z}-\frac{\partial V}{\partial z}=\frac{dw}{dt}-u\omega_2+v\omega_1$$

where the angular velocities of motion for a point are

166.
$$\omega_1=-\frac{v}{r}\qquad \omega_2=+\frac{u}{r}\qquad \omega_3=+\frac{v}{r\tan\theta}.$$

Compare diagram in my Report, page 498, or Basset, pages 13 and 14, noting the transformations of notation.

In case the earth rotates with the constant angular velocity n, carrying the fixed axes with it, the linear velocities (u, v, w) and the angular velocities $(\omega_1, \omega_2, \omega_3)$ are changed as follows, denoting these terms on the rotating earth with primes:

177.
$$u'=u\qquad v'=v+n\,r\sin\theta\qquad w'=w$$

178.
$$\omega'_1=-\frac{v+n\,r\sin\theta}{r}\qquad \omega'_2=+\frac{u}{r}\qquad \omega'_3=+\frac{v+n\,r\sin\theta}{r\tan\theta}.$$

This is due to the fact that the rotation of the earth adds the velocity $n\,r\sin\theta=n\,\varpi$ to the eastward linear velocity, because ϖ is the perpendicular distance from the axis of rotation.

The differentials $\frac{du'}{dt}$, $\frac{dv'}{dt}$, $\frac{dw'}{dt}$ evaluate into,

179.
$$\frac{du'}{dt}=\frac{du}{dt}$$
$$\frac{dv'}{dt}=\frac{dv}{dt}+\frac{d\,(n\,r\sin\theta)}{dt}=\frac{dv}{dt}+u\,n\cos\theta+w\,n\sin\theta$$
$$\frac{dw'}{dt}=\frac{dw}{dt}$$

since $u=\frac{rd\theta}{dt}$ and $w=\frac{dr}{dt}$ by formulæ 153, page 497, of the International Cloud Report.

Substituting these values in the equations of motion for the rotating earth, which are the same as those of 155 with the letters all primed, and taking the equivalents of dx, dy, dz in polar cordinates from 153, we have:

180.
$$-\frac{1}{\rho}\frac{\partial P}{r\partial\theta}=\frac{du}{dt}-(v+n\,r\sin\theta)\frac{(v+n\,r\sin\theta)}{r\tan\theta}+w\frac{u}{r},$$
$$-\frac{1}{\rho}\frac{\partial P}{r\sin\theta\,\partial\lambda}=\frac{dv}{dt}+w\frac{(v+n\,r\sin\theta)}{r}+u\frac{(v+n\,r\sin\theta)}{r\tan\theta}+u\,n\cos\theta+w\,n\sin\theta,$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial r}-g=\frac{dw}{dt}-u\frac{u}{r}-(v+n\,r\sin\theta)\frac{(v+n\,r\sin\theta)}{r}.$$

The external forces derived from the potential V are:

$$-\frac{\partial V}{\partial x}=0,\qquad -\frac{\partial V}{\partial y}=0,\qquad -\frac{\partial V}{\partial z}=-g.$$

Performing the algebraic work, these equations reduce to

[1] See Monthly Weather Review for February, 1902, Vol. XXX, p. 81.

181.
$$-\frac{1}{\rho}\frac{\partial P}{r\partial\theta} = \frac{du}{dt} - \frac{v^2\cot\theta + uw}{r} - 2n\cos\theta\,.\,v - r\,n^2\sin\theta\cos\theta\,,$$
$$-\frac{1}{\rho}\frac{\partial P}{r\sin\theta\partial\lambda} = \frac{dv}{dt} + \frac{uv\cot\theta + vw}{r} + 2n\cos\theta\,.\,u + 2n\sin\theta\,.\,w\,,$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial r} - g = \frac{dw}{dt} - \frac{u^2+v^2}{r} - 2n\sin\theta\,.\,v - rn^2\sin^2\theta.$$

The successive terms are the inertia, the centrifugal forces, the deflecting force, and the forces which change the figure of the earth from a sphere into an elipsoid of revolution.

(2) THE CYLINDRICAL EQUATIONS OF MOTION ON THE ROTATING EARTH.

If the axis of rotation of the earth is taken as the axis of rotation in cylindrical coordinates, the tangential velocity $= v + n\,\varpi$; but if the axis of rotation is any radius of the earth extended above the surface, the tangential velocity becomes $= v + n\,\varpi\cos\theta$. Hence we have, in cylindrical coordinates,

182.
$$u' = u \qquad w'_1 = 0$$
$$v' = v + n\,\varpi\cos\theta \qquad w'_2 = 0$$
$$w' = w \qquad w'_3 = n\cos\theta + \frac{v}{\varpi}.$$

The differentials $\frac{du'}{dt}, \frac{dv'}{dt}, \frac{dw'}{dt}$ evaluate into,

183.
$$\frac{du'}{dt} = \frac{du}{dt}$$
$$\frac{dv'}{dt} = \frac{dv}{dt} + \frac{d\,(n\,\varpi\cos\theta)}{dt} = \frac{dv}{dt} + u\,n\cos\theta$$
$$\frac{dw'}{dt} = \frac{dw}{dt}$$

since $u = \frac{d\varpi}{dt}$, by formulæ 152, and $\cos\theta$ is a constant. Substituting these values in the equations of motion for the rotating earth, which are the same as those of 155, with the letters all primed, and taking the equivalents of dx, dy, dz, in cylindrical coordinates from 152, we have:

184.
$$-\frac{1}{\rho}\frac{\partial P}{\partial\varpi} = \frac{du}{dt} - (v + n\,\varpi\cos\theta)\left(n\cos\theta + \frac{v}{\varpi}\right)$$
$$-\frac{1}{\rho}\frac{\partial P}{\varpi\partial\varphi} = \frac{dv}{dt} + u\,n\cos\theta + u\left(n\cos\theta + \frac{v}{\varpi}\right)$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial z} - g = \frac{dw}{dt}.$$

The external forces derived from the potential V are:
$$-\frac{\partial V}{\partial x} = 0, \qquad -\frac{\partial V}{\partial y} = 0, \qquad -\frac{\partial V}{\partial z} = -g.$$

Performing the algebraic work, these equations reduce to

185.
$$-\frac{1}{\rho}\frac{\partial P}{\partial\varpi} = \frac{du}{dt} - 2n\cos\theta\,.\,v - \frac{v^2}{\varpi} = \frac{du}{dt} - (2n\cos\theta + \nu_1)\,v$$
$$-\frac{1}{\rho}\frac{\partial P}{\varpi\partial\varphi} = \frac{dv}{dt} + 2n\cos\theta\,.\,u + \frac{uv}{\varpi} = \frac{dv}{dt} + (2n\cos\theta + \nu_1)\,u$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial r} - g = \frac{dw}{dt}$$

where the term $+\,\varpi\,n^2\cos^2\theta$ is neglected in the first equation, and $\nu_1 = \frac{v}{\varpi}$ the relative angular velocity.

The successive terms are the inertia, the deflecting force, and the centrifugal forces.

REMARKS ON THE SEVERAL TERMS IN THE GENERAL EQUATIONS OF MOTION.

It is customary to add to the terms developed in a frictionless medium, a term expressing the retardation of acceleration due to friction, either in Ferrel's form $+\,k\,(u, v, w)$, which is proportional to the velocity and expresses a sliding friction, or in Oberbeck's form $\frac{k}{\rho}\,\Delta^2\,(u, v, w)$, which expresses a retardation proportional to the turbulent internal resistances of a mixing fluid. This function is hard to evaluate on account of the uncertainty which attaches to the invisible internal motions, and to the effect of discontinuous surfaces separating different velocities and temperatures. Near the ground turbulent motions and large coefficients of friction up to about 300–500 meters are required; above this level and especially in the higher strata the coefficient of friction is very small.

The inertia terms $\frac{d\,(u, v, w)}{dt}$ disappear in steady motion, and they are small in slow changes of velocities. There are, however, cases in which inertia may amount to a considerable quantity, as where a tornado, in passing along its path, sucks in new masses of air, and transforms them suddenly from rest into excessively rapid motion. Also, when the cyclonic vortex raises masses of air from strata having slow motion into strata of rapid velocities; but especially where countercurrents meet, and the stream lines are bent and reflexed in their direction.

These two terms, friction and inertia, act in the path of motion and they directly affect the quantity of kinetic energy possessed by the elementary masses. All forces which act at right angles to the path, such as the centrifugal and the deflecting forces, do not change the momentum, but they do alter the direction of the path. Hence, in integrating for the kinetic energy in an orbit, or in a circuit, the centrifugal and the deflecting forces drop out of the equations, but they must be retained when discussing the angle that the stream line makes with the isobars, which angle expresses the influence of the velocity potential function on the motion. The following integration of the general equations will establish these propositions.

INTEGRATION OF THE GENERAL EQUATIONS OF MOTION IN POLAR COORDINATES.

Make the following substitutions in 181:

197.
$$\frac{v}{r} = \nu\sin\theta$$
$$\frac{v^2\cot\theta}{r} = v\cos\theta\,.\,\nu$$
$$\frac{u\,v\cot\theta}{r} = u\cos\theta\,.\,\nu$$

and neglect the terms in n^2, which are very small, with the result that,

200.
$$-\frac{1}{\rho}\frac{\partial P}{\partial x} = \frac{du}{dt} - \cos\theta\,(2n+\nu)\,v + \frac{uw}{r}$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial y} = \frac{dv}{dt} + \cos\theta\,(2n+\nu)\,u + \sin\theta\,(2n+\nu)\,w$$
$$-\frac{1}{\rho}\frac{\partial P}{\partial z} = \frac{dw}{dt} - \sin\theta\,(2n+\nu)\,v - \frac{u^2}{r} + g.$$

Now multiply these equations respectively by dx, dy, dz, and remember that $v\partial x = u\partial y$, $w\partial x = u\partial z$, $w\partial y = v\partial z$; take the sum of the partial differentials, the result being,

203. $$-\frac{\partial P}{\rho} = u\partial u + v\partial v + w\partial w + g\partial z.$$

The integral of this is,

$$\int -\frac{\partial P}{\rho} = \tfrac{1}{2}(u^2 + v^2 + w^2) + gz + \text{const.} = \tfrac{1}{2}q^2 + gz + \text{const.}$$

This is the fundamental equation of steady motion found in all treatises on hydrodynamics; its discussion is carried on in Table 81, International Cloud Report. The centrifugal and the deflecting forces have disappeared, and the integral is equivalent to the kinetic energy, $\frac{1}{2}q^2$, plus the external force due to the acceleration of gravitation. An arbitrary term may be added to express the frictional retardation.

If the integration is between two points of a fluid that has the same density throughout, the term $\int -\frac{\partial P}{\rho} = -\frac{P}{\rho}$ simply. Such lines of homogeneous integration may be found by observing the surfaces of equal density in the atmosphere, or, a mean density between two points may be assumed in place of the existing variable density. If the velocity term $\frac{1}{2}q^2$ is neglected, we obtain $dP = -g\rho dz$, and this is the simple form from which the usual hypsometric formulæ for barometric reductions are derived. Compare formulæ 54, Table 66, p. 490.

It is noted, however, that the usual method employed in static barometric reductions is incomplete, and that the velocity term $\frac{1}{2}(q^2 - q_0^2)$, where q, q_0 are the observed velocities at the two points limiting the path of integration, has been omitted.

If the integration is continued in any closed circuit the gravity term disappears from the equation, and the velocity terms alone remain. This line integral (C.) measures the work done in moving the unit mass once around the circuit, while $A = \frac{dC}{dt}$ is the rate of doing the work, or the activity. From this point of view the circulation of the atmosphere may be treated by the ordinary theory of the line integral. It is more convenient to observe the velocities than the pressures and densities around a circuit, in the present state of meteorology.

EXPRESSIONS FOR THE GRADIENTS OF PRESSURE.

If we take the formulæ for acceleration, Cloud Report, page 499,

155.
$$\dot{u}_1 = -\frac{1}{\rho}\frac{\partial P}{\partial x} - \frac{\partial V}{\partial x}$$
$$\dot{v}_1 = -\frac{1}{\rho}\frac{\partial P}{\partial y} - \frac{\partial V}{\partial y}$$
$$\dot{w}_1 = -\frac{1}{\rho}\frac{\partial P}{\partial z} - \frac{\partial V}{\partial z}$$

we can write for the gradient,[1]

501.
$$G_x = -\frac{\partial P}{\partial x} - \rho\frac{\partial V}{\partial x} = \rho\,\dot{u}_1$$
$$G_y = -\frac{\partial P}{\partial y} - \rho\frac{\partial V}{\partial y} = \rho\,\dot{v}_1$$
$$G_z = -\frac{\partial P}{\partial z} - \rho\frac{\partial V}{\partial z} = \rho\,\dot{w}_1.$$

The gradient terms, $-\rho\frac{\partial V}{\partial x}$ in latitude, and $-\rho\frac{\partial V}{\partial y}$ in longitude, are small terms, while $-\rho\frac{\partial V}{\partial z}$ is the principal term, and these are due to the attraction of the earth upon the atmosphere. The terms $-\frac{\partial P}{\partial x}$ in latitude, $-\frac{\partial P}{\partial y}$ in longitude, and $-\frac{\partial P}{\partial z}$ in altitude are the gradients due to the thermal disturbance of the isobaric surfaces, the first two being the gradient terms producing the horizontal flow of the atmosphere, and the last one the term which causes the up and down movement of the atmosphere by the variations of the normal buoyancy from that of stable equilibrium as controlled by the static terms in the potential function for external force V.

[1] The series of equations beginning with 501 may be considered as an extension of the system given in the International Cloud Report, which ends on page 603.

It is next important to evaluate the gradient terms for use in practical meteorology. There are many ways of doing this, as is indicated by the collection of formulæ in Table 65, page 489, of the International Cloud Report. There is a generally accepted convention which is adopted as the basis for the practical measures of gradients by the mercurial barometer.

Thus, the difference of barometric pressure, G, at two points which are 111 111 meters apart in a horizontal direction, is taken as the standard for reductions.

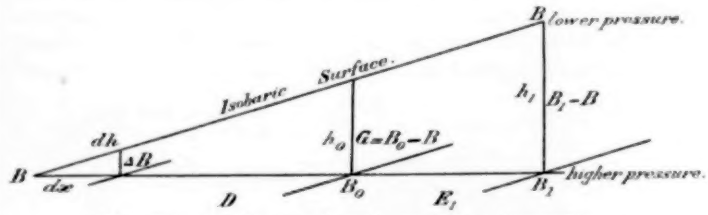


FIG. 21.—Vertical section through the atmosphere.

In fig. 21, which shows a vertical section through the atmosphere, let

D = 111 111 meters = 1° on surface of the earth,
dx = 1 meter,
E = any distance between given points of observation.

Then,

502.
$$\frac{B_1 - B}{E_1} = \frac{B_0 - B}{D} = \frac{G}{D} = \frac{G}{111\,111} = \frac{\Delta B}{dx};$$
$$G = (B_1 - B)\frac{D}{E_1}.$$

It is necessary first to find G from the observed values of B at two stations at the distance E_1 from each other.

EVALUATION OF THE COEFFICIENT $\frac{dh}{dB}$ AND OTHER TERMS.

If the change in elevation of the isobaric surface is as follows: h_1 at distance E_1, h_0 at distance D, dh at distance dx, then,

503. $g\frac{h_1}{E_1} = g\frac{h_0}{D} = g\frac{dh}{dx} = g\tan a = gb$ measures the acceleration.

Also by the law of falling bodies, $v = \sqrt{2gh}$ for the velocity.

I. We have,

504. $\frac{dh}{dx} = \frac{h_0}{D} = \frac{h_1}{E_1} = \frac{l}{E_l}$ for the top of the homogeneous atmosphere.

505. $\frac{dB}{dx} = \frac{B_0 - B}{D} = \frac{G}{D} = \frac{G}{111\,111} = \frac{\partial P}{\partial x}\cdot\frac{1}{g_0\rho_m}$, from 24, p. 487 of the Cloud Report.

Hence,

506. $$\frac{dh}{dB} = \frac{h_0}{B_0 - B} = \frac{l}{E_l}\frac{D}{G} = \frac{l}{E_l}\frac{E_1}{B_1 - B} = \frac{l}{E_l}\frac{E_l}{B_l - B} = \frac{l}{B_l} = \frac{RT}{B_l}$$

since $$\frac{D}{G} = \frac{E_1}{B_1 - B} = \frac{E_l}{B_l - B} = \frac{E_l}{B_l},$$

because B at the top of the homogeneous column l is negligible compared with B_l at the bottom of it. B_l is in this connection the barometric pressure at the surface, and $B_l = B_n = 0.760$ meter.

II. We have by 50, page 490, for the standard weight of the atmosphere,

507. $$p_o = \sigma h = \sigma_o l = \sigma_m B_n. \quad \text{Hence,}$$

508. $$h = \frac{\sigma_o}{\sigma} l = \frac{\sigma_m}{\sigma} B_n. \quad \text{That is, } h = l \text{ for } \sigma = \sigma_o. \quad \text{Hence,}$$

509. $$h = l = \frac{\sigma_m}{\sigma_o} B_n. \quad \text{Therefore,}$$

510. $$s = \frac{\sigma_m}{\sigma_o} = \frac{l}{B_n} = \frac{RT}{B_n} = \frac{13{,}595.8}{1.29305} = \frac{7{,}991.04}{0.760} = 10{,}514.5.$$

511. $$dh = \frac{\sigma_m}{\sigma_o} dB = \frac{RT}{B_n} dB = 10{,}514.5\, dB = s\, dB.$$

512. $$\frac{dh}{dx} = 10{,}514.5 \frac{B_o - B}{D} = 10{,}514.5 \frac{G}{111\,111} = 0.09463 G.$$

III. Let Γ = the gradient force per meter; that is, for $dx = 1$.

513. $\Gamma = \Delta P = g_o \rho_m \Delta B$ in terms of the units of force P.

514. $\Gamma = \Delta p = \sigma_m \Delta B$ in terms of the units of weight p.

The gradient force changes with the temperature.

Let Γ_o = the gradient force for $T_o = 273°$ C. and $B_n = 0.760$ meter.

Γ = the gradient force for T and B.

515. $$\Gamma = \Gamma_o \frac{T}{T_o} \frac{B_n}{B}.$$

IV. To evaluate $-\frac{1}{\rho}\frac{\partial P}{\partial x}$ and $-\frac{1}{\rho}\frac{\partial p}{\partial x}$:

516. We have $P_o = g_o \rho_m B_n$; and hence,

517. $$-\frac{1}{\rho}\frac{\partial P}{\partial x} = -\frac{1}{\rho} g_o \rho_m \frac{\partial B}{\partial x} = -\frac{1}{\rho}\frac{g_o \rho_m}{111\,111} G = -\frac{0.0012 G}{\rho}.$$

(G is in meters.)

518. Also, we have $p_o = \sigma_m B_n$; and hence,

519. $$-\frac{1}{\rho}\frac{\partial p}{\partial x} = -\frac{1}{\rho}\sigma_m \frac{\partial B}{\partial x} = -\frac{1}{\rho}\frac{\sigma_m}{111\,111} G = 0.12237 G.$$

(G is in meters.)

Numerous other evaluations of $-\frac{1}{\rho}\frac{\partial P}{\partial x}$ are given in Table 65, p. 489, of the Cloud Report.

EVALUATION OF THE GRADIENTS IN POLAR COORDINATES.

Since the angular velocity of the rotating earth is $n \sin\theta = \frac{v'}{r}$, where v' is the absolute eastward velocity, and $r = 6{,}370{,}191 + h$ meters, we have $n = 0.00007292$, and also $n \cos\theta = \frac{v' \cot\theta}{r}$, in which r can be taken practically equal to R. The general polar equations of motion become, by substituting these values in 181,

194. $$-\frac{1}{\rho}\frac{\partial P}{\partial x} = \frac{du}{dt} - \frac{\cot\theta}{r}(2v' + v)v + \frac{uw}{r}$$

$$-\frac{1}{\rho}\frac{\partial P}{\partial y} = \frac{dv}{dt} + \frac{\cot\theta}{r}(2v' + v)u + (2v' + v)\frac{w}{r}$$

$$-\frac{1}{\rho}\frac{\partial P}{\partial z} = \frac{dw}{dt} - \frac{1}{r}(2v' + v)v - \frac{u^2}{r} + g.$$

The terms in n^2 which give the figure to the rotating earth have been omitted, and the inertia terms become equal to zero for steady motions of the atmosphere; also, for all except computations of great precision the terms in w can be neglected.

To evaluate the acceleration $\frac{1}{\rho}\frac{\partial P}{\partial x}$, we have, first, from 47,

47a. $$\frac{1}{\rho} = \frac{1}{\rho_o}\frac{P_o}{P}\frac{T}{T_o} = \frac{1}{\rho}\frac{P_o}{P}(1 + at)$$

$$= \frac{1}{\rho_o}\frac{B_n}{B}\frac{T}{T_o}\frac{1}{n_1}, \text{ for variations of gravity, since } g = g_o n_1,$$

$$= \frac{1}{\rho_o}\frac{760}{273}\frac{T}{B} \quad \text{for constant gravity and } B \text{ in mm.}$$

From the formulae on page 489,

47b. $$\frac{1}{\rho}\frac{\partial P}{\partial x} = \frac{1}{\rho} g_o \rho_m \frac{dB}{dx}, \text{ and since } \frac{dB}{dx} = \frac{G_x}{D} = \frac{G_x}{111\,111} \text{ in meters}$$

$$= \frac{1}{\rho}\frac{g_o \rho_m}{111\,111} G_x \text{ for the gradient measured in meters}$$

$$= \frac{1}{\rho}\frac{g_o \rho_m}{111\,111\,111} G_x \text{ for the gradient } G_x = B_o - B \text{ in mm}$$

$$= \frac{1}{\rho_o}\frac{B_n}{T_o}\frac{T}{B}\frac{g_o \rho_m}{D} G_x$$

520. $$= \frac{13.5958}{0.00129305} \times \frac{760}{273} \times \frac{9.806}{111\,111\,111} \times \frac{T}{B} \times G_x$$

521. $$= 0.0025833 \frac{T}{B} G_x$$

522. $$= \frac{\cot\theta}{r}(2v' + v)v, \text{ by equation 194.} \quad \text{Hence,}$$

523. $$G_x = +\,387.102 \frac{B}{T}\frac{\cot\theta}{r}(2v' + v)v,$$

and similarly,

$$G_y = -\,387.102 \frac{B}{T}\frac{\cot\theta}{r}(2v' + v)u,$$

$$G_z = +\,387.102 \frac{B}{T}\left[\frac{1}{r}(2v' + v)v + \frac{u^2}{r} - g\right].$$

Since v' is a function of θ, that is, $v' = nr\sin\theta$, these terms can be computed by simple tables, such as those in Tables 104, 105, 106, of the International Cloud Report, where some of the terms are evaluated. By expressing the variation of $387.102 \times \frac{B}{T}$ in a table with B and T as the arguments, the several products can be quickly computed.

Examples:

I. For $B = 700$ mm. and $T = 260°$ C., $\frac{B}{T} = 2.6923$;

For $\theta = 30°$ north polar distance, $2v' = 464.5$ meters per second;

For $v = 40$ meters per second, $(2v' + v)\,v = 20{,}180$.

Hence, $G_x = 387.102 \frac{B}{T}\frac{\cot\theta}{R}(2v' + v)\,v = 5.71$ millimeters per 111 111 meters.

II. This latter has been computed from the tables as follows:

$$378.102 \frac{B}{T} = 1{,}042.2;$$

$$\frac{v'}{R}\cot\theta \,.\, 2v = 0.005052, \text{ by Table 104;}$$

$$\frac{\cot\theta}{R} \,.\, v \,.\, v = 0.000435, \text{ by Table 106.}$$

The sum of these is $\frac{\cot\theta}{R}(2v' + v)v = 0.005487$. Hence the product, $G_x = 1{,}042.2 \times 0.005487 = 5.71$ millimeters per 111 111 meters. Similarly, the gradients G_y and G_z can be computed.

For these values of B and T, we find in other examples,

$\left.\begin{matrix}\theta = 40° \\ v = 45°\end{matrix}\right\} G_x = 6.89 \quad \left.\begin{matrix}\theta = 50° \\ v = 50°\end{matrix}\right\} G_x = 5.23 \quad \left.\begin{matrix}\theta = 60° \\ v = 55°\end{matrix}\right\} G_x = 4.47.$

We are at last in a position to examine the system of gradients in the United States on the 10,000-foot plane and on the 3,500-foot plane. For we have obtained by the nephoscope and theodolite observations as given in the Cloud Report a large number of corresponding values of u and v, which enter these equations. The values of B and T on these planes have been carefully determined for each month, and also the gradients by which such values can be determined at any time. This will enable us to discuss the effect of friction at these planes, by means of the residuals which occur between the values of G as found by these formulæ and those read off from the charts of isobars contained in the Barometry Report of 1900–1901.

Furthermore, our Weather Bureau stations will soon be provided with suitable tables for computing pressures on the 3,500-foot and the 10,000-foot planes, and this will give daily configurations of isobars on these two levels. If, in addition, we had measures of the velocity of the clouds, $q\ (u, v, w)$, above each station by means of nephoscopic observations, it would enable us to make complete dynamic computations of the forces acting in cyclones and anticyclones, as is seen by an inspection of the formulæ.

Since the tabular computations are constructed for average conditions, it is of the utmost importance that *check observations* be made on these two planes in order to control these dynamic discussions and make them more perfect. Such observations can be made by balloon ascensions up to 2 or 3 miles, or by kite ascensions up to 10,000 feet, or by certain computations on cloud observations.

It seems to me very clear that a series of suitable research explorations would soon result in placing our dynamic meteorology upon a satisfactory scientific basis, and put an end to the fruitless speculations which have done so little to advance our knowledge of the laws of the atmospheric motions.

THE EQUATION OF CONTINUITY, AND SOME DERIVED RELATIONS.

1. The equation of continuity can be found as follows:

Consider a cylinder of the height z and radius ϖ, into which air of the density ρ streams equally from all sides with the velocity $-u$, since the direction is negative.

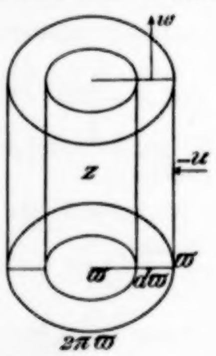


Fig. 22.—Illustrating the formation of the equation of continuity.

The amount of instreaming air in the unit of time is

$$-2\pi\omega\ z\ u\rho.$$

If the air is incompressible, then there will stream into a cylinder, whose radius is smaller by $d\varpi$, the amount $-2\pi\ (\varpi - d\varpi)\ zu\rho$, and at the same time there will escape upward between these two cylinders the amount $2\pi\varpi\ d\varpi\ w\rho$. Hence

524. $$-2\pi\varpi\ z\ u\rho + 2\pi\ (\varpi - d\varpi)\ z\ u\rho = -2\pi d\varpi\ zu\rho = 2\pi\varpi d\varpi\ w\rho.$$

Integrating along the entire radius from 0 to ϖ, we have,

$$-2\pi\rho\int_0^{\varpi} zud\varpi = 2\pi\rho\int_0^{\varpi}\varpi d\varpi\ w.$$

Therefore, $-zu\varpi = \frac{1}{2}\varpi^2 w$, and the equation of continuity becomes

487. $$-2uz = \varpi w.$$

This applies to pure vortex motion, and it finds some examples in the atmosphere, such as in tornadoes, in many hurricanes, and in some highly developed cyclones.

It may be remarked that in treating of the general circulation of the atmosphere, the application of the pure vortex law $\varpi v =$ constant, has failed to give correct results, for example in the writings of Ferrel, von Helmholtz, Oberbeck, Sprung, and others. This leads to the theory of contracting rings on the earth with progressive motion towards the poles, or expanding rings with progression towards the equator. While the law of the sum of the momenta $\Sigma\ mv = 0$ must prevail, the rings are in nature broken up into such complex stream lines as to render integration by the simple vortex law too rough and ready a method. We must, therefore, study the theory of typical stream lines, before attempting any general integration for the entire circulation.

The following derived relations are convenient:

2. Since $-2uz = \varpi w$, we have $-u = \frac{w}{2z}\ \varpi$

$$= \frac{c}{2}\ \varpi, \text{ if } w = cz.$$

3. For z and $-u$ both constant, we have $\varpi zu = -\text{ const.} = \psi$.

Hence, $z = -\frac{\text{const.}}{u\varpi} = -\left(\frac{\text{const.}}{c/2}\right)\frac{1}{\varpi^2}$, and by differentiation,

$$dz = +\frac{\text{const.}}{c/2}\cdot\frac{2\varpi d\varpi}{\varpi^4} = -\varpi^2 z\frac{2d\varpi}{\varpi^3}$$

$$= -2z\frac{d\varpi}{\varpi}.\quad \text{Therefore,}$$

$$\frac{dz}{z} = -2\frac{d\varpi}{\varpi};\ \text{also, } \varpi\frac{dz}{dt} = -2z\frac{d\varpi}{dt}.$$

4. These give the form for the current function ψ, and the velocity potential φ, in two cases.

488. I. $\psi = u\varpi z = -\frac{c}{2}\varpi^2 z = \varphi z.$ II. $\psi = -cz.$

489. $\varphi = -\frac{c}{2}\varpi^2.$ $\varphi = -c.$

$a = \frac{\lambda}{k-c}.$ $a = \frac{\lambda}{k}.$

5. If the current function is modified through a deflecting force and also through friction, then the equation of motion has two solutions, so that the roots of

$$u\ \frac{\partial v}{\partial\varpi} + \frac{uv}{\varpi} + \lambda u + kv = 0$$

are, by 438,

1. $u = -\frac{c}{2}\varpi.$

$$v = +\frac{\lambda}{k-c}\frac{c}{2}\varpi = -\frac{\lambda}{k-c}u.$$

2. $u = -\frac{c}{\varpi}.$

$$v = +\frac{\lambda}{k}\frac{c}{2} = -\frac{\lambda}{k}u.$$

In obtaining the velocities of the rotation, v, we can modify the current function, as follows, namely, multiply by

$$a = \frac{\lambda}{k-c},\ \text{and } a = \frac{\lambda}{k} \text{ in the two cases.}$$

6. Hence, by using Stokes's current functions, we find for the velocities u, v, w in the two cases,

490. Case I.

$$u = + \frac{1}{\varpi} \frac{\partial \psi}{\partial z} = \frac{\varphi}{\varpi} = - \frac{c}{2} \varpi.$$

$$v = + \frac{a\psi}{\varpi} = - \frac{\lambda z}{k - c} \frac{c}{2} \varpi = + \frac{\lambda}{k - c} z\, u.$$

$$w = - \frac{1}{\varpi} \frac{\partial \psi}{\partial \varpi} = + cz = - \frac{2u}{\varpi} z = - \frac{2v}{\varpi} \frac{k - c}{\lambda}.$$

Case II.

$$u = + \frac{1}{\varpi} \frac{\partial \psi}{\partial z} = \frac{\varphi}{\varpi} = - \frac{c}{\varpi}.$$

$$v = + \frac{a\psi}{\varpi} = - \frac{\lambda}{k} \frac{c}{\varpi} z.$$

$$w = - \frac{1}{\varpi} \frac{\partial \psi}{\partial \varpi} = 0.$$

7. In unconstrained motion the vortex law of preservation of areas is

$$v\varpi = \frac{c}{2} \varpi^2 z = 2g \frac{\varpi z}{v} = \varpi u z = \text{constant, by 307.}$$

$$w z \varpi^2 = \text{const., by 308, introducing the value } v^2 = 2gz.$$

This vortex law when not modified by deflection and friction becomes,

492. Case I.

$$v\varpi = \frac{\lambda}{k - c} \frac{c}{2} \varpi^2 z = - \text{const.}$$

Case II.

$$v\varpi = \frac{\lambda}{k} cz = - \text{const.}$$

8. The inclination of the stream line to the isobars is,

491. Case I.

$$\cot i = + \frac{\lambda}{k - c} z.$$

Case II.

$$\cot i = \frac{\lambda}{k} z.$$

9. The equation of continuity (163) is satisfied by these following values:

493.

$$\frac{\partial u}{\partial \varpi} + \frac{u}{\varpi} + \frac{\partial w}{\partial z} = - \frac{c}{2} - \frac{c}{2} + c = 0.$$

10. The equation for gradient has a term to express the unevaluated variation due to temperature effects, $f(t_x)$, and it becomes, for the radial component,

494.

$$- \frac{\mu}{\rho} G_x = - \frac{1}{\rho} \frac{\partial P}{\partial x}$$

$$= - \frac{c}{2} \varpi \left[k - c + \lambda \frac{\lambda z}{k - c} + \frac{c}{2} \left(\frac{\lambda z}{k - c} \right)^2 \right] + f(t_x)$$

$$= - \frac{c}{2} \varpi \left[k - c + \lambda \cot i + \frac{c}{2} \cot^2 i \right] + f(t_x).$$

11. The total velocity is

495.

$$q^2 = u^2 + v^2 + w^2 = \frac{u^2}{\sin^2 i} + w^2 = u^2 \left(\frac{1}{\sin^2 i} + \frac{4z^2}{\varpi^2} \right) + f(t_x).$$

12. The variation of pressure can be expressed by

496.

$$\log P_0 - \log P = \frac{(q^2 - q_0^2) + 2g(z - z_0)}{360862\ (1 + \alpha t)} + f_1(k) + f_2(t).$$

These formulæ are all collected in Table 121, page 602, of my International Cloud Report.

This system of formula applies directly only to the pure vortex motions that satisfy the assumed current function and velocity potential. The components u, v, w, are so simply interrelated that it is usually possible to make enough observations of some sort from which to derive all the other vortex relations. Applications of them were made in the International Cloud Report to two cases; (1) The waterspout observed off Cottage City, Marthas Vineyard, Mass., August 19, 1896, on page 633; upon this important formation, a fuller report will be published. (2) The average velocities in a cyclone from the data in Table 126, as given on page 629 of the International Cloud Report. The outcome of these computations is to show that the natural stream lines of the atmosphere conform on the average to these formulæ. There are, however, wide divergences of such a type as to indicate that the pure vortex motion is seriously modified by several conflicting forces, and that the true problems for the meteorologist consist in discovering the nature and amount of these deviations of the currents of the atmosphere from the simple laws. This is in fact a task of great difficulty, but it has now become evident what should be the course of scientific development for meteorology. There is little use in a further discussion of the general theorems at the present time, but there is great need of procuring the right kind of observations for use in such problems. The Weather Bureau has accordingly been engaged in such a reconstruction of its data as will contribute to the solution of these problems for the United States. We have already published a large number of nephoscope velocities for the eastern half of the country; the velocities of the upper currents for the West Indies have been determined for about three years, July 1899–July 1902, and their computation will be commenced at once; similar nephoscope observations will be undertaken for the Rocky Mountain and Pacific districts, beginning about July 1902. Our barometric observations have been thoroughly reduced for the years 1873 to the present time, and the tables necessary for reductions to the three reference planes are in hand for the construction of daily maps at three levels, containing the system of isobars corresponding with them. It will be necessary to revise the temperature and vapor tension observations and reduce them to homogeneous systems before our data will be complete for the application of the theoretical equations to the observational data. It is desirable to put an end to general mathematical speculation in meteorology, and to substitute for it definite comparisons between observations and computations together with dependent solutions for the outstanding unknown quantities.

THE PROBLEMS OF THE AQUEOUS VAPOR CONTENTS OF THE ATMOSPHERE.

I shall allow myself only a few remarks regarding the methods which were used in my report for the discussion of the various complicated problems that concern the aqueous vapor contents of the atmosphere, because the details are too complex for a brief summary like this, and also because the work was given in such an extended form as to enable students to follow it without difficulty. There are, however, a few leading ideas to which attention may be especially directed, as they serve for an introduction to the subject in general.

There is collected in the International Cloud Report, Table 64, "Fundamental constants," a series of elementary constants in the English and metric systems, with the logarithms of the constants, and also a set of elementary formulæ which are most useful in meteorological studies. They cover nearly all the simple relations which constantly recur in manifold forms in the treatises and papers on meteorological subjects, and by transformation and combination a multitude of different relations can be readily obtained. Tables 63, 64, and 65 supply the basis for much descriptive matter commonly found in treatises, in so compact and accurate a form as to quite supersede the lengthy statements with which the same laws are usually presented, and this is a great convenience for the student and computer. Those who will take the trouble to become familiar with these tables will find much saving of time in general work, and also they will be guarded from such errors of thought and statement as are likely to occur

from not having these formulæ in mind, or accessible for convenient reference.

In treating the vapor problems I have referred all the formulæ to the ratio $\frac{e}{B}$, vapor tension divided by barometric pressure, as the most convenient and accurate argument for combination with another argument, as the height h, the temperature T, or the pressure B. The Table 67 summarizes the formulæ for the hypsometric reductions, and they are more fully explained in the forthcoming Barometry Report. The general idea is that having found the ratio $\frac{e_o}{B_o}$ at the base of a column, the application of Hann's law for the diminution of the vapor pressure with the height gives the most accurate average law for computing the integral of the vapor tension throughout the entire column. A small secondary term can be added whenever our knowledge of the facts justifies such an increased degree of accuracy, though it is usually of little importance, especially for a series of observations where mean results are required.

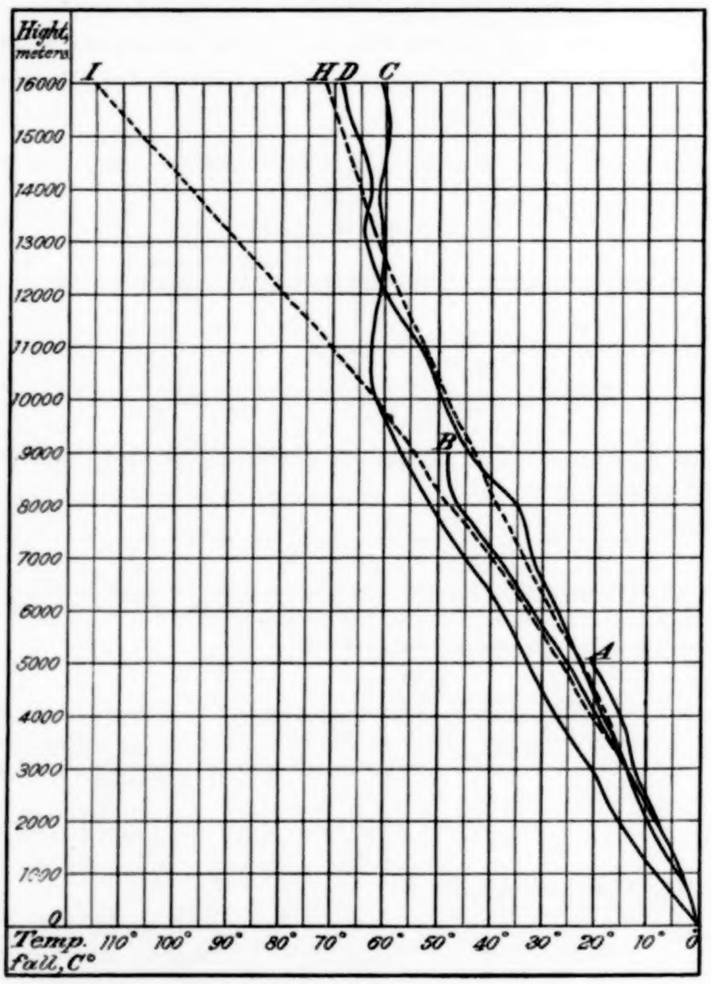
In the development of the α, β, γ, δ stages of the adiabatic thermodynamic formulae, the ratio $\frac{e}{B}$ is made the primary argument by the series of transformations given on Table 72. These formulæ are reduced to numerical tables, 94–102, and their accuracy is tested by comparing directly with the Hertzian logarithmic formulæ, as given in the examples of Table 108. Their use involves a series of solutions by trials, which though laborious, yet lead to perfectly rigorous results, and after a little practise it becomes quite easy to obtain the true trial values without much difficulty. The graphical diagrams of Hertz give only approximate values, because they throw out the vapor tension term in the critical places and thus render inaccurate the very problems they were designed to discuss. Special applications were made to finding the gradients of pressure, temperature, and vapor tension in the α, β, γ, δ stages, and the results are found in Tables 147 for metric measures, and in Tables 153 for English measures.

TABLE 21.—*Comparison of several determinations of the total temperature change from the surface to high levels.*

	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*
16000	....	....	−60.4	−68.3	....	....	....	−71.1	−115.0*
15000	....	....	−59.1	−66.0	....	....	....	−68.0	−106.0*
14000	....	....	−60.9	−62.5	....	....	....	−64.7	−97.0*
13000	....	....	−60.1	−63.5	....	....	....	−61.0	−88.0*
12000	....	....	−61.0	−60.3	....	....	....	−57.0	−79.0*
11000	....	....	−62.8	−52.7	....	....	....	−52.6	−70.0*
10000	....	....	−60.6	−48.5	....	−60	−62	−48.1	−61.0†
9000	....	−48.0	−57.0	−44.6	−56.8	−51	−56	−43.4	−54.5†
8000	....	−47.4	−51.0	−34.9	−48.7	−47	−48	−38.5	−47.9†
7000	....	−38.4	−44.8	−31.7	−39.8	−38	−41	−33.3	−39.6†
6000	....	−32.0	−37.5	−26.9	−34.6	−30	−34	−28.1	−32.9†
5000	−20.8	−25.5	−32.3	−23.1	−27.0	−25	−26	−22.8	−26.0†
4000	−15.0	−19.6	−28.0	−19.0	−20.7	−18	−21	−17.9	−19.9†
3000	−12.9	−14.3	−19.5	−13.0	−15.4	−13	−15	−13.1	−14.5†
2000	−7.9	−8.5	−15.8	−9.6	−9.9	−9	−8	−7.8	−9.0†
1000	−3.2	−3.7	−8.3	−3.8	5.0	−4	−4	−3.9	−4.3†
0000	0.0	0.0	0.0	0.0	0.0	0	0	0.0	0.0†

A = 49 ascensions not above 5,000 meters in manned balloons.
B = 12 trips upward and 5 downward, not above 10,000 meters, in manned balloons.
C = 9 ascensions of unmanned balloons above 10,000 meters.
D = Bigelow's compiled data, Tables 156, I. II., International Cloud Report.
E = Berson's mean results, Meteorologische Zeitschrift, Oct. 1901, p. 449.
F = Teisserenc de Bort's mean results, Meteorologische Zeitschrift, Oct. 1901, p. 449.
G = Hergesell's mean results. Meteorologische Zeitschrift. Oct. 1901, p. 449.
H = Bigelow's mean results, Tables 157, I. II., International Cloud Report.
I = The mean of *E*, *F*, *G* up to 10,000 meters, and a gradient of 9° per 1,000 meters from 11,000 to 16,000 meters.
* Hergesell's assumed gradient 9° per 1,000 meters.
† Mean of *E*, *F*, *G*.

Finally the same tables were employed to discuss the important problem of the difference between an adiabatic atmosphere and the one given by the upper strata observations, whereby a new method was illustrated, with results in Table 162. The value of this computation depends, of course, upon the data B, T, e, adopted for the upper atmosphere, as measured by the balloon and kite ascensions. It was especially necessary to have the temperatures at high levels, and for this purpose I collected such material as was available up to the end of the year 1896, when I began this compilation, and for that purpose employed the 102 balloon ascensions enumerated in Table 155, embracing all those then available for the United States, England, France, Germany, and Russia. I expressed myself cautiously regarding the result, page 750, holding the computation as preliminary to a fuller one which would become possible when accurate observations had been accumulated for the upper air temperatures, and I have therefore had an interest in examining the Berlin report of the German balloon ascensions.[2] In the first volume of this work is contained the data for each ascension, and in the Meteorologische Zeitschrift, October, 1901, page 449, H. Hergesell gives a summary of the resulting free air temperatures. I have extracted the observed temperatures from this report, interpolated them to each round 1,000-meter level, and computed the total temperature fall from the surface to the respective strata, with the result given in Table 21 and fig. 23. If the ascensions are



A. and *B.* Berlin observations with manned balloons.
C. Berlin observations with unmanned balloons.
D. Bigelow's summary from all countries.
H. Bigelow's adopted mean result.
I. Berlin adopted mean result.

FIG. 23.—Total temperature fall from the surface to high levels by several systems.

divided into three sets, *A*, those reaching heights between the surface and 5,000 meters, *B*, those between the surface and 10,000 meters, and *C*, those between the surface and 16,000

[2] Wissenschaftliche Luftfahrten. Assmann und Berson. 3 Bänden. Berlin, 1899.

meters, we have the following remarkable data. Class *A* contains 49 ascensions of manned balloons, and gives a temperature fall of 20.8° at the 5,000-meter level; class *B* contains 12 upward and 5 downward trips of manned balloons and gives a fall of 25.5° at the 5,000-meter level, or 5° more than class *A*; class *C* contains 12 ascensions of unmanned balloons, with a fall of 32.3° at 5,000 meters, or 11.5° more than in class *A*, and 57° at 9,000 meters, or 9° more than in class *B*. This class shows also a fall of 60.6° at 10,000 meters and 60.4° at 16,000 meters. These widely different temperature falls by classes *A, B, C* may possibly be explained by those who are familiar with the circumstances, but the fact deserves attention; also the other fact that there is no temperature fall between 10,000 and 16,000 meters as observed in the Berlin unmanned balloon ascensions. In column *D* is given the result of my own compilation found by taking the mean of all the figures as they stand in Tables 156, I, II; and on fig. 21 the line *D* is seen to fall between *A* and *B* and to cross *C* at the height of 12,000 meters.

In his review of the Berlin ascensions H. Hergesell gave the Berson results as shown as in column *E*, the Teisserenc de Bort results as in column *F*, and his own results as in column *G*. He also stated the conclusion that above 10,000 meters the adiabatic rate of temperature fall in free air prevails, and this may be considered as 9.0° per 1,000 meters, as suggested by him. Column *I* is the mean value of *E, F, G*, up to 10,000 meters, and from that level to 16,000 the fall is calculated at 9.0° per 1,000 meters, these values being plotted on fig. 21. Finally, by taking the means of the data given in Tables 157, I, II, which was derived from Charts 78, 79, as constructed to determine the gradients for each month in the year, we have the data of column *H*, also plotted on fig. 21. It is seen that my adopted result, *H*, lies midway between *A* and *B*, and is a fair average of all the ascensions taken in the unmanned balloons, while the adopted Berlin result, *I*, is 45° lower at 16,000 meters, giving at that level a temperature of —115° approximately. There is a further consideration of importance to be noted in this connection. E. Rogovsky in his paper on the "Temperature and composition of the atmospheres of planets and the sun," Astrophysics, November, 1901, discusses the temperature of the interplanetary medium (according to Pouillet —142° C., Froelich —131° to —127°), and assumes it to be —142° C. A fair assumption regarding the efficient depth of the atmosphere makes it 64,000 meters or about 40 miles, and hence we have the following data:

Height of atmosphere.	Bigelow.		Berlin.	
	Temperature.	Necessary gradients.	Temperature.	Necessary gradients.
Meters.	° *C.*	° *C.*	° *C.*	° *C.*
64,000	—142		—142	
		—1.8		—0.9
16,000	— 55		—100	
		—4.4		—7.2
Surface	15		15	

If the temperature falls from 15° at the surface to —55° at 16,000 meters with a gradient of about —4.4° per 1,000 meters, then to reach —142° at 64,000 meters the gradient should on the average be —1.8°. It will be seen by my Charts 78 and 79, International Cloud Report, that I adopted an increasingly slower temperature fall with the height in the strata above 10,000 meters, in accordance with this general view. If the Berlin theory is assumed that a fall of 9.0° per 1,000 meters prevails above the 10,000-foot level, then it must somewhere rapidly decrease to a very small gradient in order not to diminish the exterpolated temperatures far below that value assigned by certain astrophysicists to the celestial medium at the earth's distance from the sun. In fact the gradient becomes one-tenth of the adiabatic rate, which was actually assumed. If the temperature —260° C. is that of the interplanetary medium, as supposed by other writers, these inferences must be modified accordingly.

From these two considerations, (1) that my temperature system includes the data of the highest balloon ascensions, and (2) that my gradients are in harmony with the requirements of astrophysics, I shall let my computations on the heat difference between the adiabatic and the actual atmosphere stand as they were given in my report. The accurate measurement of the temperatures in the highest strata is a very difficult process, and all efforts to secure reliable results deserve the hearty support of meteorological physicists. There are several problems whose solution depends upon the possession of such data in a satisfactory form.

THE FIRST NATIONAL METEOROLOGICAL CONGRESS OF MEXICO.[1]

By Prof. FRANK H. BIGELOW.

The report of the proceedings of the first Meteorological Congress of Mexico has been published and contains the acts and resolutions and papers presented during the sessions of November 1, 2, 3, 1900, held under the auspices of the Scientific Society "Antonio Alzate." The president was Señor D. Manuel Fernandez Leal, and there were about thirty members present at the sessions in an official capacity, The proceedings opened at 9:20 a. m., Thursday, November 1, 1900, with an address by the President, after which the papers to be read were presented. In the afternoon the session opened at 3:35, C. A. Gonzalez presiding, at which a discussion and the adoption of resolutions occurred, the purpose being to indicate the necessary steps in the organization of a national meteorological service for weather forecasts and climatology along recent modern lines, as laid down by the International Meteorological Congresses. Also a report was approved on the formation of a survey of the atmosphere by cloud observations, in three classes: (1) direction and motion of clouds by eye, (2) by nephoscopes, (3) by theodolites and photogrammeters.

On Friday, November 2, at 9:20 a. m., F. R. Rey presiding, papers were read by S. Diaz, L. G. Léo, M. Moreno y Anda, Señorita R. Sánchez Suárez, and J. M. Romero. At 4:30 p. m., D. M. Leal presiding, resolutions were passed as to the hours of observation, reduction of temperatures to the mean of 24 hourly observations, computation of the vapor tension, reduction of the barometer to zero temperature and to sea level, classification of clouds, the computation of the mean direction of the wind, and as to various special observations.

On Saturday, November 3, at 9 a. m., G. B. y Puga presiding, the reading of papers was continued by A. Prieto, Leal, and Olmedo. A discussion took place with the adoption of the following resolutions:

The first National Meteorological Congress expresses its desire that the Federal Government should provide for the organization of a meteorological service upon a basis analogous to that which exists in the United States; especially, will it be desirable to secure a modification of the existing services, taking account of the elements which actually exist, in conformity with the following principles: (1) That the Central Meteorological Observatory of Mexico be recognized as the central office of the national service; (2) that it be the center of all the scientific relations; (3) that the Federal Government equip this office for that work; (4) that the government establish and equip other observatories in suitable localities for cooperation with it; (5) that the state governments organize a network of stations in their own districts; (6) that a suitable telegraphic service be developed for meteorological messages; and (7) that a commission be organized to further the development of these plans.

At 4:30 p. m., J. de M. Tamborrel presiding, the discussion was continued, and resolutions were adopted concerning the

[1] Actas, resoluciones y memorias del primer Congreso Meteorologico Nacional, iniciado por la Sociedad Cientifica "Antonio Alzate," y celebrado en la ciudad de México los dias 1, 2 y 3 de Novimbre de 1900. Mexico. 1901. 272 pp.

publication of meteorological observations in daily, monthly, and annual reports; the forms for the record of the observations; the symbols for meteorological phenomena; the self-registers and their reduction to standard, and the commencement of the meteorological year on the first of December. It was further recommended that observations be conducted on earthquake phenomena, that the atmosphere be explored with balloons, that the ozone of the air and the formation of clouds be studied. Provision was made for the second congress in the following year. This congress met in the same place on December 17, 18, 19, and 20, 1901. The prospectus has already been published in the MONTHLY WEATHER REVIEW, page 512, November 1901, and a résumé of the proceedings will be found on page 132 of the REVIEW for March, 1902.

All meteorologists will be gratified to see these evidences of activity in Mexico, and especially will they appreciate the fact that the movement to establish a National Mexican Service is going forward along the most approved lines. It is evident that the leaders are planning to conform to the resolutions of the International Meteorological Congress generally, and also to keep in touch with the practical system of the United States Weather Bureau, as far as possible. It is extremely important that the Mexican Plateau should be placed under a strictly scientific régime as promptly as can be done, and that a common network of stations and telegraphic exchanges be instituted between the United States and Mexico, such as has long existed between the United States and Canada.

NOTE ON THE OSCILLATION PERIOD OF LAKE ERIE.

By R. A. HARRIS, U. S. Coast and Geodetic Survey, dated June 27, 1902.

In a paper recently issued by the Weather Bureau entitled Wind Velocity and Fluctuations of Water Level on Lake Erie, the author, Prof. Alfred J. Henry, finds the theoretical period of oscillation for the lake to be about eighteen hours; he notes that observations made at Buffalo and Amherstburg indicate a period of fourteen hours, or a little more. In determining this 18-hour period, the lake is assumed to be isochronal with a rectangular body of water 50 feet deep and 246 statute miles long. The object of the present note is to point out how the observed period may be made to harmonize with a plausible theoretical period.

In any statement of this question which regards the depth of the lake as uniform, one can hardly assume the average depth to be so small as 50 feet; probably 60 or 65 feet is a good value.

It would be a difficult matter to ascertain mathematically the free period of a body so irregular in outline and so variable in depth as Lake Erie. Nevertheless, the following approximation appears to be useful. Consider a square area oscillating in the manner shown in the accompanying fig. 1. We can imagine thin partitions to be erected along the lines of motion and the oscillation will go on as before. That is, any one of the pointed areas will have a free period of oscillation the same as that of the square. They are isochronal with a rectangle whose length is equal to a side of the square, although their common least length is the square's diagonal, or $\sqrt{2}$ times the length of a side. If, therefore, Lake Erie be represented by a leaf-like figure composed of several of the pointed areas, Maumee Bay marking one end and Buffalo the other, the free period of such a body would be only $1/\sqrt{2}$, or 0.7071 times the period of a rectangle whose length is this extreme length of the lake. (See U. S. Coast and Geodetic Survey Report, 1900, pp. 586-589.) We can readily suppose that as a matter of fact the lake lies between the two hypothetical bodies. With a length of 250 miles and a depth of 60 feet, the mean of the theoretical period for the leaf-like figure and that for a rectangle is fourteen and one-quarter hours, which is about the observed period of the lake.

West of Sandusky the average depth of the lake is about 30 feet. This is partially separated from the eastern or main portion by several islands and shoals. If this partial boundary were made sufficiently complete it would constitute the western boundary of the oscillating body, and from this region a derived wave would progress to Amherstburg, the time of transmission being about 1.7 hours. As the highs or lows at Amherstburg are on an average, but little later than the lows or highs at Buffalo, it is probable that the oscillation extends the whole length of the lake, although its period may be slightly influenced by the partial barrier that actually exists, and by the shallowness of the western end. The great depths found between Dunkirk and Long Point must also have some slight effect upon the free period of the body.

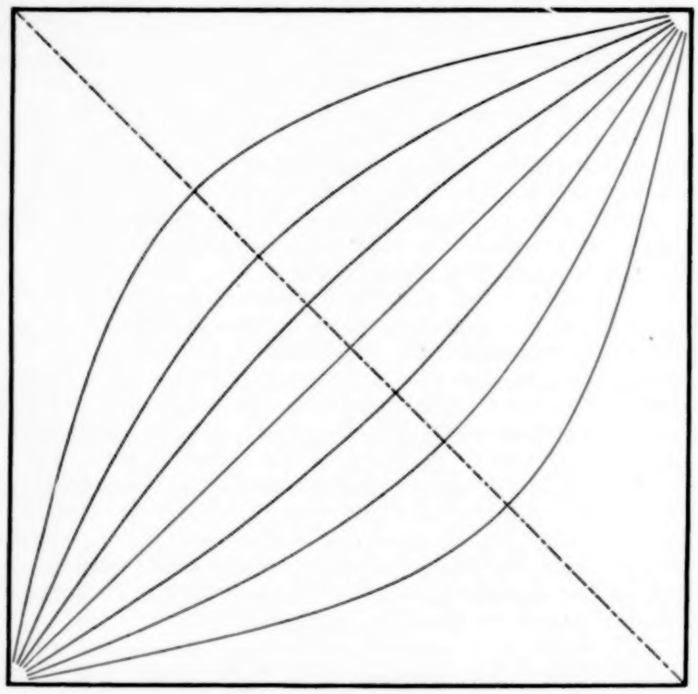


FIG. 1.

Questions connected with the oscillations of lakes can be studied experimentally by means of models suitably constructed. For, by ignoring friction the method of dynamical similarity can be applied. In practise the vertical scale of the model must generally be greater than the horizontal in order to obtain depths sufficiently great for the purpose. The only restrictions are that the maximum depth in the model shall be but a small fraction of the length, and that wherever the motion is considerable, the slopes of the bottom along the lines of motion must be small. If n denote the ratio of any horizontal distance in the model to the actual distance, and if m denote the ratio for heights (so that m/n is the ratio of the vertical to the horizontal scale of the model), then the period ratio will be $n/\sqrt{m}$.

NOTES AND EXTRACTS.

APPARATUS FOR REGISTERING THUNDERSTORMS.

Some years ago the late Mr. G. J. Symons constructed a very complete apparatus for registering the time and intensity of thunder. According to Nature for May 15, p. 65 (1902), a new piece of apparatus for thunderstorm registration has been constructed by Fathers Fenyi and Schreiber:

The apparatus consists mainly of three portions; the first consists of a horizontal magnetic needle mounted on a vertical support between a small and sensitive coil of wire, the needle and its stop being connected with a battery, a bell, and a registering apparatus, the needle when in contact with its stop completing the circuit. The registering apparatus is a small electro-magnet which actuates a pen in contact with a disc, and the latter is connected with a clock and moves with regular velocity. The third and very important portion of the arrangement is the coherer, which is composed of two delicately suspended needles nearly in contact; these are connected in a circuit, which includes the coil in which the horizontal needle is placed, a cell, and the long intercepting wire, corresponding to the tall post with wire of the Marconi telegraph system. The apparatus works in the following manner: A distant flash of lightning starts a wave-impulse, and this is led to the coherer by the intercepting wire; the needles move and touch each other, thus completing the circuit, and allow a current to pass through the coil. This coil immediately causes the needle inside it to be deflected to the stop. The second circuit is thus completed, the needle on the registering apparatus marks a deflection on the disc, the bell is rung, and the vibration caused by the latter separates the needles of the coherer. According to the account here given, the instrument is very efficient and has been found to record storms as many as 20 miles away, while on another occasion the instrument during very fine weather was working "apparently rebelliously," but was really recording a great storm raging at Budapest (as shown by the time of occurrence and record at each place), a distance of 110 kilometers from the apparatus.—*C. A.*

LIGHTNING RECORDER.

In the Annual Report for 1901-02 of St. Ignatius College, Cleveland, Ohio, the Reverend F. L. Odenbach publishes an appendix on the work of his meteorological observatory during the past year. This begins with an account of his new lightning recorder, or ceraunograph. He says that on seeing the first working model of the apparatus for wireless telegraphy and its action under the influence of electro-magnetic waves, he came to the conclusion that it was possible to harness lightning and force it to record its own doings. On May 1, 1901, the first warning was received, and two hours later the thundercloud was over the station. The various parts of the instrument were a relay, a telegraph sounder, a coherer, choking coil, two batteries, a recording drum, or chronograph, a copper collector on the roof of the college, and a copper wire leading from it down to the instrument in the observatory. A lightning flash sends out in all directions rays of electro-magnetic waves, which travel like light. The waves from a distant flash strike the copper collector and descend on the wire to the primary circuit of the relay. Their way is blocked by the choking coil, and therefore they pass in great part through the coherer. The moment they do so this tube becomes a conductor for the primary current; the relay goes into action and closes a secondary circuit; the recording magnet moves the pen and makes the record; but at the same time the sounder in this same secondary circuit clicks, shakes the coherer, and all is over until a second distant flash sends another electric wave. This first crude instrument worked successfully during the whole of the summer of 1901, but is now replaced by an improved apparatus. In this new apparatus a graphite coherer is used, consisting of sticks of graphite such as are known as "A. W. Faber's Siberian leads for artists' pencils." The record for 1901 shows that the thunderstorms reach Cleveland from one to three hours after the first record of distant lightning. In a few cases this record is not followed by a thunderstorm, but these are very rare. In general, a Weather Bureau station furnished with this apparatus should be able to give an hour's notice of an approaching local storm. The silent electric discharges attending snowstorms may also enable one to predict the approaching snow.

INDEX FOR WEATHER MAPS.

Father Odenbach has also devised a method of indexing the types of weather maps, by the use of what he calls "symbolic shorthand." He divides the United States weather map into sixteen regions, designated by names and numbers. Each weather map can be described by the position of its areas of high and low pressure, e. g., the expression $\frac{9-16}{12-14}$ for January 1, means that on that day there were "highs" in regions 9 and 16 and "lows" in regions 12 and 14. A card bearing the date of the map and the proper descriptive formula is made up for each map for the whole ten years. The cards are then arranged according to the formulæ and all those having the same formula are collected together; after copying the whole series of dates on one card the others are destroyed as no longer needed. With this index the student is able to ascertain whether the combination of highs and lows that he sees on any weather map has ever occurred before, and if so, on what dates.—*C. A.*

RADIO-ACTIVE RAIN.

The newest theories as to the origin of atmospheric electricity and the formation of rain, and in fact as to the very nature of electricity itself, have received interesting confirmation by some recent observations by Mr. C. T. R. Wilson, the assistant of Prof. J. J. Thomson in the Cavendish Laboratory, Cambridge, England. We quote the following from Nature, June 5, 1902, p. 143, as an abstract of the paper read before the Philosophical Society at Cambridge on May 5:

As the experiments of Elster and Geitel and of Rutherford have shown, a negatively charged body exposed in the atmosphere becomes radioactive, apparently showing the presence of some radioactive substance in the atmosphere, it occurred to the author to test whether any of this radioactive substance is carried down in rain. Freshly fallen rain water (less than 50 c. c. was generally used) was found when exposed to dryness to leave behind a radioactive residue. The radioactivity was detected by means of the increase in the ionisation of the air within a small vessel, of which the top, or, in some experiments, the bottom, was of thin aluminum or gold leaf, the other walls being of brass. The metal surface on which the rain had been evaporated was placed close up to the aluminum or gold leaf, and the rate of movement of a small gold leaf which served to measure the ionisation was observed (v. Roy. Soc. Proc., vol. lxviii, p. 151). In many cases the radioactivity obtained from the rain was sufficient to increase the ionization five or six fold. From the evaporation of distilled water, of tap water, or of rain water which had stood for many hours no radioactivity was obtained. Like the induced radioactivity obtained on a negatively charged body, that derived from rain gradually dies away, falling to about half its initial value in the course of an hour.—*C. A.*

LABORATORY WORK IN PHYSICAL GEOGRAPHY AND METEOROLOGY.

There can be no doubt that classes in physiography in our high schools may profit by a laboratory course in elementary meteorology, embracing such observations as can be made by means of the simpler meteorological instruments, and by the eye alone. Such observations, if systematically made and recorded, are valuable *nature studies;* they also lead to a better understanding of the salient features of climate, of the periodic and accidental changes in atmospheric conditions, and of the effect of all these upon health.

The student actually needs and ordinarily uses nothing more than a properly ruled note book in which to record his obser-

vations. Such were provided gratuitously for the first class of this kind in 1882 in Washington, D. C. Among the published manuals that will be found helpful to the teacher may be mentioned Practical Exercises in Elementary Meteorology, by R. DeC. Ward, Boston, 1899, and Observations and Exercises on the Weather, by James A. Price, American Book Company, New York, 1902. The first of these is especially adapted to normal schools and colleges. The second, by Mr. Price, is not too difficult for the graded public schools.

Mr. Price first provides by means of suitably ruled pages for the systematic record of personal observations of the weather conditions, the clouds, the winds, and the prominent features of storms. Then follow observations by the aid of such instrumens as the barometer, hygrometer, and thermometers; and finally, by means of the daily weather maps, the observed local conditions are correlated with the general weather conditions in the United States.

The general scheme is to be commended. It is sufficiently flexible to be readily adjusted to the capabilities of any school, and by devoting a few minutes to observations daily a knowledge of the various meteorological elements may easily be acquired. The numerous printed questions under each topic are admirably adapted to stimulate the student to observe.

It is important, however, that the most approved methods of observing and recording be followed and it is to be regretted that Mr. Price has needlessly complicated his cloud nomenclature by adding to and altering the principal cloud forms recognized by the International Cloud Committee. Strato-nimbus should be included under nimbus clouds, and strato-cumulus should not be differentiated from cumulostratus.

The graphic method of indicating wind direction and fluctuations by means of arrows may have its advantages, but in general abbreviations and symbols should conform to the international system.

There appears to be some confusion in the use of the term hygrometer. In Part V, questions 20–22, the readings of the hygrometer are compared with the readings of the thermometer, as though the former were simply a wet-bulb thermometer. This is an unauthorized new use of the word hygrometer and reprehensible from every point of view. It is very important that there be no double meaning and doubtful meaning of words used in science. On a following page, "hygrometer curves" are provided for and these will be of little value unless they represent either the absolute or the relative humidity of the air. No method has been given whereby the student can find either the absolute or the relative humidity. Table III is intended to give the dew-point when we know the readings of dry and wet bulb thermometers, or the so-called psychrometer; but unfortunately it revives a very crude method long since obsolete and probably never before commended to American observers. It was included in the Smithsonian Tables of fifty years ago merely as of historical interest.

By the footnote on page 44 the author states that to obviate confusion the cyclone is considered as extending "from the center of one anticyclone through the 'low' to the center of the next anticyclone." This is objectionable. Anticyclones should be considered quite apart from cyclones. The progressive movement of the former does not coincide with the latter. Furthermore, the anticyclone is now considered to be the dominating factor in determining weather conditions, rather than the subordinate factor that the above method of study would indicate.

A misplaced decimal point in Table I makes all elevations 1,000 times too small, an error that is liable to mislead inexperienced observers.

A careful revision of this manual should be made before a second edition is issued.—*H. H. K.*

ON THE ALTITUDE OF THE AURORA.

The altitude of the aurora above the earth's surface is a matter on which the widest diversity of opinion still exists. The Editor has endeavored to show that we have no satisfactory basis for the opinion that the auroral light always emanates from some point very high above the earth but that on the contrary observations are best reconciled by the assumption that the source of the light is quite near the earth, and perhaps never higher than the lowest clouds. In fact, it is quite possible that the beams and arcs are illusions.

Now that within a few years we shall have a maximum of sunspots, and therefore an increased number of auroras, the Editor hopes that many will turn their attention to a simple method of observing that may be very helpful in settling the points at issue. If the aurora is an optical illusion, such as the rainbow or halo, then two observers at neighboring stations, or one observer by moving from place to place, will observe the beams and arches of light at the same altitude above the horizon. But if these are material entities having a definite locus, then, as the observer changes his location, the arches and beams will change theirs, as compared with the stars in their neighborhood. The question at issue may apparently be settled if an observer will first make a sketch of the stars in the neighborhood of some special auroral beam or arch, then move quickly a short distance north, south, east, or west, make a second careful sketch of the same stars and beam, then return to the first station and repeat the sketch. As the auroral beams always appear to be in motion, one must compare the average of the first and third sketches with the second sketch, in order to eliminate the influence of any motion of the beam. If this comparison shows that the change in the observer's position has caused an apparent change in the position of the auroral beam, then we have the necessary data for computing its distance and altitude. If several observers start from the center and proceed in different directions, each making his own set of sketches, the results will of course be still more satisfactory. It is ordinarily thought that the reason why computed auroral altitudes are so discrepant is because distant observers have such difficulty in assuring themselves that they are simultaneously observing the same point of light. This difficulty is avoided in the present suggested method. In fact one observer starting from the intersection of two street car lines can travel quickly in four different directions successively and do all the work himself, so as to leave no doubt that he is observing the same point.—*C. A.*

SEA TEMPERATURE AND SHORE CLIMATE.

A memoir on the seasonal variations of atmospheric temperature in the British Isles by Mr. W. N. Shaw, the new Director of the Meteorological Office in London, has been published by the Royal Society and brings out the fact that a small variation in the temperature of the air over Great Britain is observed to be superimposed on the regular annual variation of temperature. All the successive stages of temperature changes from summer to winter, and vice versa, seem to be delayed by the influence of the ocean.

Commenting on this general result, Nature (May 29, 1902, p. 116,) says that in order to investigate this subject The Meteorological Council has made a new departure:

> In connection with the publication of the Monthly Pilot Chart of the North Atlantic and Mediterranean Oceans, the cooperation of the mercantile marine has been enlisted to promptly supply daily records of sea temperatures during their voyages. A gratifying response resulted in the return of more than 2,500 ocean temperatures for the month of January, 1902, and 2,750 for February. This mass of valuable information has been grouped in spaces of 2° of latitude by 2° of longitude and the means obtained. The results between 30° north and 60° north form the new feature of the pilot charts of the London Meteorological Office. * * * Here we have the commencement of an investigation, which, if continued and improved as may be found necessary, should be fruitful of the most useful results.

From 1872 to 1891 the Weather Bureau carried out similar temperature records along the Atlantic coast in rivers and harbors, but, owing to our prevailing westerly winds, the Atlantic Ocean temperatures have but little effect upon American weather. Temperature observations of the Pacific Ocean water would be more interesting, but we doubt whether it would explain the anomalies of the Pacific coast climates. The actual influence of our Great Lakes on the climate of stations on the windward side is appreciable by the increased cloudiness twenty miles from the shore, but not much beyond; its influence on the temperature is only appreciable by the prevention of early frosts by reason of the formation of cloud and fog. The general influence of the Atlantic Ocean on the weather of Great Britain, or of the Pacific Ocean on the weather of northern California, Oregon, and Washington is to produce cloud, fog, and rain and thus affect the temperature indirectly. The direct effect of a rise or fall in the temperature of the ocean surface is analogous to the direct effect of the changes in the temperature of a land surface. Both should be expressible by an algebraic formula, consisting essentially of two terms, viz: (1) a term expressing the heat given back to the air by conduction and convection and radiation, all of which, of course, is much larger by daytime and smaller by night-time for the land as compared to the ocean, and (2) a second term expressing the quantity of latent heat conveyed to the air by the evaporation of moisture, which on the average of the day and night is greater for the ocean than for the land. But when the lower layers of air thus warmed and moistened have moved to a great distance horizontally or vertically, or when, without much motion, this air is cooled down by radiation, then the land air keeps clear longer than the ocean air and it is this property that produces the great variety of climates to the leeward of the water.

It will be interesting to compare the actual figures for the monthly mean air temperatures on the west coast of Great Britain and on the west coast of North America, and the following table gives the figures as read off from the charts of Bartholomew's Physical Atlas, Plate VI of the British Isles, and Plate VIII for the United States and Canada. We have taken four representative points on the British coast, but only two on the American coast, because the latter are so much farther south in latitude that, strictly speaking, only the northernmost, viz, Vancouver Island, latitude 50°, should be compared with Lands End, latitude 50°.

Months.	Great Britain.				America.	
	Hebrides. Lat. 57°.	North Ireland. Lat. 55°.	South Ireland. Lat. 51°.	Lands End. Lat. 50°.	Vancouver. Lat. 50°.	Mouth of Columbia. Lat. 46°.
	°	°	°	°	°	°
January	42.5	42.0	44.5	44.5	42.0	40.0
February	42.0	42.0	45.0	45.5	40.0	42.0
March	42.0	43.0	46.0	46.0	43.0	46.0
April	45.0	47.0	49.0	49.5	47.0	49.0
May	49.0	51.0	52.5	53.0	49.0	55.0
June	54.0	55.0	57.5	58.5	54.0	57.0
July	55.5	58.0	59.5	61.5	55.0	60.0
August	56.0	58.0	60.0	61.5	55.0	60.0
September	54.0	55.0	57.0	59.0	53.0	57.0
October	49.5	50.0	52.0	54.0	49.0	53.0
November	45.5	45.0	48.0	49.0	45.0	47.0
December	44.0	44.0	46.0	46.0	40.0	42.0
Annual temperature	47.0	49.0	51.5	52.5	49.0	50.0
Annual ranges	14.0	16.0	14.0	16.0	15,0	20.0

The general character of the weather is controlled principally by the vertical ascent or descent of the wind and by its northern or southern direction much more than by the fact that it blows from the ocean. All winds that come from the Pacific have sufficient moisture to form rain and prevent the occurrence of either extremely hot or extremely cold weather, provided only they can be forced to rise up and be cooled dynamically or blow northward and be cooled by radiation. Both these causes conspire to form the winter rains on the Pacific coast north of latitude 40°, and also in Great Britain north of latitude 50°, but neither of them contribute to the formation of rain at any time of the ordinary year south of San Francisco, Cal., latitude 38°.—*C. A.*

TREES AS FORECASTERS OF RAIN.

A correspondent writes:

People often say "it is a sign of rain when the wind blows up the leaves so as to show the white lower side." What is the element of truth, if any, in this that has given rise to this current statement?

Since there is no known meteorological reason for the phenomenon described, the question was submitted to the Chief of the Bureau of Plant Industry, United States Department of Agriculture, and we give herewith the reply received from Mr. A. F. Woods, Pathologist and Physiologist.

It is true that people often say that the turning up of the leaves is a sign of rain. I have heard the remark many times, but as far as my observations go the sign does not seem to be a very sure one. There are many kinds of trees, like the silver-leaf poplars, in fact all the poplars, the maples, and some of the oaks, which turn their leaves up whenever there is a fairly strong, steady wind, but they do it as much in clear weather as in rainy. It has been suggested to me that possibly the belief may have arisen from the fact that winds capable of turning leaves over very often precede or follow rainstorms, and as people are usually on the alert when the general atmospheric conditions favor rain, looking for signs to confirm the general feeling they have that it is going to rain, it might be that the turning up of the leaves would be especially noted at such times.

METEOROLOGY IN ARGENTINA.

It is well known that our countryman, Dr. B. A. Gould, of Cambridge, Mass., after having established an astronomical observatory in Argentina, turned his attention to climatology and inaugurated a meteorological office, under the general directorship of Mr. Walter G. Davis, who had accompanied him from this country. After publishing about twenty annual volumes of meteorological observations and climatological investigations, Mr. Davis has now succeeded in realizing the great step in meteorology that has been taken by nearly every other climatological bureau. He has namely, organized in Buenos Ayres, under the Argentine Department of Agriculture, a branch office that publishes a daily weather map based on telegrams from all available points. A recent letter from Mr. Davis states that—

Since the beginning of this year I have had my time fully occupied in getting the daily weather map service organized; it is now fairly started, but far from being complete. We have free use of the national telegraph lines, as well as of nearly all the private railway wires, for the transmission of the 2 p. m. observations. At present there are nearly 70 stations sending in complete observations and 350 pluviometric stations. Within the next few months I hope to have about 130 second-class stations and a large increase in the rain-reporting stations. The observations are sent here (Buenos Ayres) and the maps printed in our own establishment. The recent extension of the telegraph lines to the southern territories has been a great boon to us from a meteorological point of view; the coast line is now at Rio Gallegos, in Santa Cruz, and another branch is being constructed near the foot of the Cordillera from latitude 38° to 47° south, and then crosses the country to the Atlantic coast. This is a most important line for us, as it will give us communication with the region where nearly all the "pamperos" have their birth and development.

No attempt has been made at forecasting, as I consider it better to have some experience with the conditions as shown by the daily maps before undertaking to do too much. I trust, however, that this branch of the work will come in due time.

The daily map published by the meteorological office at Buenos Ayres makes a very imposing appearance. It is 16.2 inches high by 11.1 broad and extends between the forty-sixth and seventy-seventh degrees of longitude west from Greenwich and between the twenty-first and fifty-seventh degrees of south

latitude. This region in the Southern Hemisphere corresponds to a portion of the Northern Hemisphere, extending north and south, between Turks Island, the Bahamas, and Nain, Labrador, and, east and west, between the meridians of Washington, D. C., and Cape Farewell, Greenland. When this large region in the Southern Hemisphere shall have had its storms and "pamperos," its isobars and isotherms thoroughly studied, we shall feel that a great advance has been made in the meteorology of the globe.

We are not informed whether the daily weather map of the Province of Buenos Ayres, published for ten years past by the Observatory at La Plata, will be discontinued, but evidently the much more comprehensive work of the general Department of Agriculture must supersede that.

The elaborate presentation of Argentine climatology compiled by Dr. Davis for the official volume of statistics of that republic is about to appear, in Spanish and English text, as a special treatise by him on the climate of that region. The climatology of Dr. Davis and his new daily weather map show that the meteorology of the South Temperate Zone of America is in excellent hands.—*C. A.*

DANCING DERVISHES OR DUST WHIRLS.

A correspondent from Statesville, N. C., under date of June 6, 1902, sends the following interesting description of a phenomenon observed by him:

I have seen many whirlwinds but never before one like that observed yesterday about 3:30 p. m., some 4 miles south of Statesville. It consisted of four separate whirlwinds which followed each other to the left around the center of a circle 10 or 15 feet in diameter, like horses going around a horse power thrashing machine. The whole circle also seemed to be moving to the left and around the center of an enlarging coil. The motion was made apparent by dust taken up from the soil, and it could not well be seen above 10 or 15 feet from the ground. Sometimes, one or more of the small whirls would rise so as not to be visible, but presently it would touch the soil again in its regular place in the procession. This beautiful and curious motion continued for five minutes or more over a spot only about 100 feet in diameter. It then advanced northward the four whirls enlarging their circle to about 75 yards and then vanishing.

Dust whirls like that described above are not uncommon in hot, dry regions like the interior of Africa or India. One was observed in Kansas in 1897 (see MONTHLY WEATHER REVIEW, Vol. XXVII, p. 111), but they are not often seen in this country. The following description from Whirls and Dust-Storms of India, by P. F. H. Baddeley, London, 1860, may be of interest:

Another curious phenomenon is often observed in a slowly-moving whirlwind; instead of appearing as a simple column, the dust whirl in contact with the ground, and for a few feet upward, is found to be composed of several distinct vortices, or spiral bodies, each one rotating on its axis as it revolves round and round the whirling circle. Each separate vortex having attached to it in its horizontal section, the same kind of fan-shaped train of dust, as was before remarked with regard to the smaller whirlwind columns.

This remarkable sight gives the idea of a fairy dance round a ring; and the motions are from all accounts, exactly imitated by the dancing Dervishes of Turkey; one of their holy exercises being to whirl round and round like a top; singly, or in company with several others, performing at the same time a gyration round in a circle, as if their dance originated in the very phenomenon now described. We may sometimes watch this motion for a length of time, without changing our position more than a few yards.

Buchan in his Handbook of Meteorology, London, 1868, page 306, gives the following explanation of these dust whirls:

Whirlwinds are often originated in the Tropics during the hot season; especially in flat, sandy deserts, which becoming unequally heated by the sun, give rise to numerous ascending currents of air. In their contact with each other, these ascending currents give rise to eddies, thus producing whirlwinds which carry up with them clouds of dust. Of this description are the *dust-whirlwinds* of India, which have been described and profusely illustrated by P. F. H. Baddeley.—*H. H. K.*

THE VARIATIONS OF THE TEMPERATURE OF THE FREE AIR AT GREAT ALTITUDES.

In the MONTHLY WEATHER REVIEW for September, 1899, Vol. XXVII, p. 411, we published a translation of a memoir by Monsieur L. Teisserenc de Bort communicating the results of over 100 balloon ascensions, made at his observatory at Trappes, near Paris, for the purpose of investigating the temperature of the upper air. Up to that time meteorologists had generally assumed that as we ascend in the atmosphere not only do the regular diurnal and annual ranges of temperature, but also the nonperiodic or irregular variations, steadily diminish, so that we soon attain a region of uniform temperature. As a first result of the work of Teisserenc de Bort it seemed likely that the nonperiodic variations diminished very little with altitude so that we never attain a region in which the air temperature remains constant throughout the year. But a more careful examination of these data by Assmann and Berson, and especially their analysis of the temperatures observed in the balloon ascensions made from Berlin, made it evident that a region of uniform temperature, after all, may exist, but much higher up than was formerly supposed. A further contribution to this subject has lately been published by Teisserenc de Bort in the Comptes Rendus of the Paris Academy of Sciences for April 28, 1902, Vol. CXXXIV, pp. 987–989, showing the variations of temperature actually observed in the zone between 8 and 13 kilometers high; this we present to our readers in the following translation.—*C. A.*

I have the honor to communicate to the Academy the results of the discussion of observations made during 236 ascents of sounding balloons sent up from my observatory for dynamic meteorology, and which rose above 11 kilometers; 74 of them attained a height of 14 kilometers. These observations extend over several years and are distributed throughout the various seasons. They permit us for the first time to study the temperature of the atmosphere in the zone above a height of 10 kilometers, bringing to light new and unexpected facts, of which the following are the more striking:

1. In general the diminution of temperature with altitude increases as we leave the lower layers and attains in the upper regions hitherto explored a value quite near to that which corresponds to the adiabatic rate in dry air, but this decrease, instead of going on proportionally as we ascend as was formerly assumed, passes through a maximum, then diminishes rapidly until it becomes nearly zero at an altitude which in our region is on an average about 11 kilometers.

2. Starting with an altitude that varies between 8 and 12 kilometers, according to the atmospheric condition, there begins a zone characterized by a very small rate of diminution of temperature, or even by a slight increase, with alternations of cooling and warming. We are not able to state precisely the thickness of this zone, but, according to the observations already made, it would seem to amount to at least several kilometers.

This is a fact of which we were ignorant up to the present time, and it deserves to be taken into very serious consideration in the study of the general circulation. I ought to add that these results are not in agreement with many previous conclusions that had been based upon very insufficient evidence.

By considering the daily atmospheric conditions, we shall at once perceive that the point of inflection of the curve of temperatures varies within rather wide limits, between the altitudes 8 and 13 kilometers. This fact has attracted my attention ever since the ascents of our sounding balloons at night-time furnished sufficiently accurate data.[1] We quickly recognized that the ascensions in which the temperature ceases to decrease at an altitude of 8 or 9 kilometers are made during weather that is under the influence of barometric depressions, and that, on the contrary, the ascensions during high pressure are characterized by an elevation of the zone where the temperature tends to become uniform.

I have given to the Physical Society of Paris, in my communication of June 16, 1899, a very fine example of this phenomenon, by comparing the curves of the 14th and of the 23d of March, 1899; nevertheless as this result was absolutely new and contrary to theoretical predictions, I desired to multiply the experiments and overcome as far as possible the many causes of error before presenting the results to the Academy.

I had first to endeavor to secure ascensions, under difficult circumstances, that should attain altitudes sufficient to assure that the phenomenon to be studied should not be confined to the extreme or highest portion of the ascent of the balloon. As we approach the equilibrium stage (where the balloon floats along horizontally), the ventilation due to the ascending movement falls and we must fear the influence on the thermometer of the radiation from the sun and from the balloon, as also the influence of the mass or sluggishness of the self-register itself. After

[1] I have already explained to the Academy, in my note of 1898, the precautions taken in order to prevent the balloon from passing too rapidly in a vertical direction through the layers of air and to thus overcome the sluggishness of the thermometers.

persevering efforts we succeeded in sending up, even in bad weather, paper balloons carrying self-registers to altitudes of 13 and 14 kilometers. Notable improvements in the instruments have enabled us to isolate the sensitive portion of the thermometer from the mass of the self-register, whose calorific sluggishness is quite large.

The records of much higher precision obtained under these conditions have fully confirmed that which we had at first noticed, and we have been able to separately consider the curves of the self-registers for different conditions, or types, of weather.

The following table is a résumé of this classification as arranged in two groups both of which indicate the same result.

Résumé of temperature measurements by means of sounding balloons.

	Years.	Location of center of high pressures.					Location of station relative to low pressures.			
		East of Europe.	Over France and Gulf of Gascony.	Over France.	West of Europe.	South and southwest of the low.†	In front.	At the side.	In path.	In central part.
		Kilo.	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*	*Kilo.*
Altitude of isothermal zone.*	1899–0	11.3	12.1	11.7	11.2	12.2	11.4	11.3	9.9	10.4
	1901–2	11.3	12.8	11.4	11.1	12.5	11.5	11.3	11.9	9.7
Altitude of zone of less than 0.4° temperature decrease per 100 meters.	1899–0	10.0	10.7	10.8	10.1	11.0	10.5	10.5	9.1	9.6
	1901–2	10.0	11.5	10.8	10.7	10.5	10.4	10.5	9.6	8.6
Altitude of zone of maximum rate of temperature decrease.	1899–0	8.0	8.7	8.8	7.7	9.2	8.2	8.3	7.4	8.1
	1901–2	8.0	8.8	8.4	8.5	8.6	8.1	8.3	8.1	7.1
Mean value of maximum rate of decrease.	1899–0	0.93	0.95	0.92	0.87	0.89	0.89	......	0.93	0.92
	1901–2	0.93	0.88	0.91	0.90	0.95	0.88	0.90	0.89	0.92

*That is, no vertical gradients.—ED.
†So in original, but may be a misprint for "the station."—ED.

As is shown by this table, the altitude of the isothermal zone is in the neighborhood of 12.5 kilometers in the central portions of the areas of high pressure and north of these, but descends to 10 kilometers in the centers of areas of low pressure. Hereafter we shall see the correlation of this altitude above sea level with the temperature of the air under these opposing atmospheric conditions.

HALOS, PARHELIC CIRCLES AND CONTACT CIRCLES.

Mr. J. A. Warren, Voluntary Observer, Santee, Nebr., sends us the following:

To-day (June 23) at 1:15 p. m., my attention was called to a peculiar halo which my informant called a rainbow, but it was no rainbow. It was a broad band of rainbow colors below the sun, and perhaps a little nearer to the horizon than to the sun. It appeared perfectly horizontal with no curvature toward or from the sun, and extended about one-ninth of the distance around the sky. It was very wide, perhaps 7°, and the colors all very distinct, the red being toward the sun. The halo continued about thirty minutes after I first saw it. The sky was overcast with a thin layer of stratus clouds and one of cirrus also. Soon after the disappearance of this halo the 22° halo appeared. Can you tell what this was? I should think it the 45° ring, except that it did not curve toward the sun and was so very wide.

A great variety of circles have been observed about the sun; they may be divided into the three following classes:

1. Halos, having the sun at the center;
2. Parhelic circles, passing through the sun;
3. Contact circles, tangent to the halos.

At least three varieties of halos have been observed: *a*, the most common of all having a radius of 22°; *b*, a halo of 46° radius; *c*, the great circle of Hevelius, having a radius of 90°. The first two of these are red on the inner side, or the side nearest the sun, and blue on the outer side, while the third is nearly white.

Four parhelic circles have been described; one parallel to the horizon, one perpendicular to it, and two very faint ones about 30° on either side of the latter. These four circles are white.

A great number of contact circles have been observed tangent to the halos, most commonly occurring at the highest and lowest points of the 22° and 46° circles. The one tangent at the highest point of the 46° circle, and both those tangent to the 22° circle, have been described as horizontal, or circumzenithal, circles, but I have been unable to find a description of a horizontal circle tangent to the lowest point of the 46° circle previous to that here given by Mr. Warren. It frequently happens, as was the case at Santee, that the tangent circle alone is observed, the halo itself being invisible.

At the numerous intersections of these various circles, parhelia, or mock suns, or sundogs, are formed, often of great brilliancy.

A more complete description of these phenomena may be found on pages 216 to 225 of Loomis's Treatise on Meteorology; pages 422–440 of Kämtz's Meteorology, translated by C. V. Walker, London, 1845; and on pages 295 and 305 of the MONTHLY WEATHER REVIEW for July, 1897, Vol. XXV.

In fig. 1 is reproduced a sketch of a brilliant solar halo observed at Fort Egbert, Alaska, transmitted by Mr. C. C. Georgeson, special agent in charge of the Experiment Station of the United States Department of Agriculture, at Sitka, Alaska.

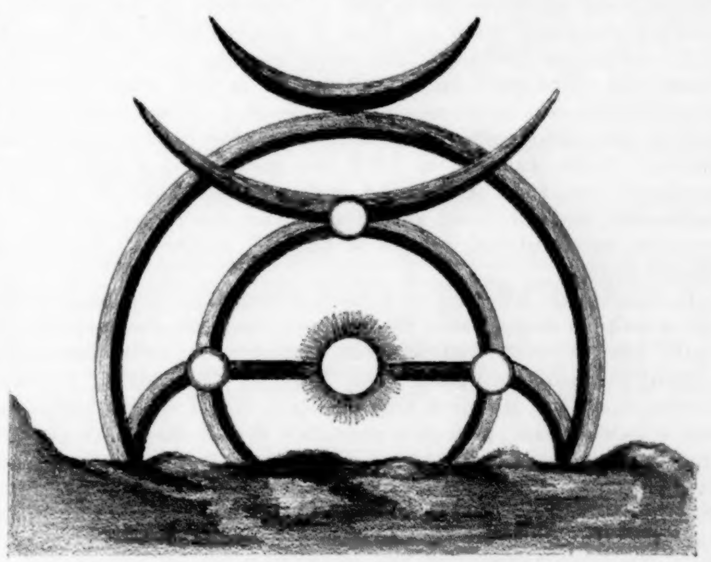


FIG. 1.—A brilliant solar halo.

No description accompanied the sketch, but apparently there were observed the halos of 22° and 46° radius, contact circles at the highest point of each of these, a horizontal parhelic circle, three parhelia on the 22° circle, with prolongations from those at the intersection of the 22° circle with the parhelic circle. In the original sketch the horizontal circle is made to appear red on the lower and blue on the upper side, but this could hardly be the case, since this circle is supposed to be caused by the reflection of light from the vertical faces of snow crystals, while the halos and the contact circles are produced by the refraction of light that passes through the snow crystals.

These phenomena are seen at their best in high latitudes when the sun is near the horizon, as was the case at Fort Egbert on March 21, 1902.—*H. H. K.*

ERRATA.

MONTHLY WEATHER REVIEW, August, 1901, page 365, column 1, equation (*a*), for "*W*" read "log *W*."

MONTHLY WEATHER REVIEW, May, 1902, page 250, column 1, line 5 from the bottom, for "produces" read "maintains"; page 255, Table 19, column 8, line 7, for "8125" read "3125"; page 257, column 2, line 8 from bottom, for "expected" read "anticipated"; page 258, column 1, line 12, for "the tornado tube" read "the half of a tornado tube".

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

CHARACTERISTICS OF THE WEATHER FOR JUNE.

A normal amount of sunshine obtained in the Middle Atlantic States, a slight deficiency in the Florida Peninsula, and marked deficiencies, ranging from 0.5 to 1.6 in the South Atlantic and Gulf States, the Plateau, southern slope, and Pacific coast regions; elsewhere it was above the normal in values ranging from 0.2 in the Ohio Valley and Tennessee to 1.2 in the middle slope region.

In the Atlantic, Gulf, and Pacific States, the southern slope, and southern and middle Plateau regions the relative humidity was below the normal from 2 to 10 per cent; elsewhere it was above the normal from 1 to 7 per cent, except in the northern Plateau region where it was normal.

In the South Atlantic and west Gulf States, North Dakota, the Plateau and northern and southern slope regions, and the Pacific coast districts there was a deficiency in precipitation ranging generally from 0.1 inch in the south Pacific district, to 2.6 inches in the southern slope region; in the east Gulf States the departure amounted to 4.2 inches; elsewhere the precipitation was in excess of the normal in values from 0.4 inch in the middle slope region to 2.5 inches in the lower Lake region. Since January 1, 1902, the accumulated deficiencies amounted to from 5.0 to 7.4 inches in the Ohio Valley and Tennessee and the Gulf and South Atlantic States, while the greatest accumulated excess is but 2.7 inches in the north Pacific region.

In the South Atlantic and Gulf States, the southern slope and southern and middle Plateau regions, and the middle and south Pacific coast districts the temperature was above the normal in values ranging from 0.4° in the South Atlantic States to 2.5° in the east Gulf States; in all other districts it was below normal, and, as a rule, the departures were greater than where excesses obtained, ranging from 2.0° to over 5.0° in New England, the northern slope, Missouri Valley, upper Mississippi Valley, the Lake region, and North Dakota. The only districts showing a very decided accumulated departure since January 1, 1902, are the upper Lake region, the northern slope, and North Dakota, where the average daily excess ranged from 2.0° to 2.8°. In the districts where accumulated deficiences obtained the values were not so great, the highest being 1.4° in the South Atlantic States.

The highest mean pressure obtained over the north Pacific and northern part of the middle Pacific districts. Another area of relatively high mean pressure overlay the Virginias and eastern Kentucky southward to southern Florida and the Gulf of Mexico.

PRESSURE.

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

The highest mean pressure, 30.00 inches or slightly higher, obtained over the north Pacific and the northern part of the middle Pacific regions, in which area the departures for the month were slightly deficient. From the Virginias and eastern Kentucky southward to the Gulf of Mexico and the extreme southern part of Florida another area of relatively high pressure, 29.95 to 29.97 inches, obtained, with departures from the normal for the month of −0.04 to −0.06 inch.

The region of lowest pressure overlay southern Arizona and southwestern New Mexico, with mean readings of somewhat less than 29.70 inches, and departures from the normal for the month of from −0.05 to −0.08 inch.

The only region where the pressure was above the normal was from northern and south-central Nebraska northward over the Dakotas and northwestward over Montana, northern Idaho and northeastern Washington, with values not exceeding +0.06 inch. In northern New England, northeastern New York, extreme northwestern Texas, and northern New Mexico the departures were greatest and ranged from −0.10 to −0.13 inch. In northeastern Colorado, Wyoming, Nebraska, except the extreme eastern and southeastern parts, South Dakota, western North Dakota, Montana, central and northern Idaho, Washington, and northern Oregon, the pressure increased over that of May, 1902, from 0.01 to 0.11 inch; elsewhere it diminished, and generally with marked changes—in the Middle Atlantic and New England States, lower Lake region, upper Lake region, except about southern Lake Michigan, and in central California, the decrease amounted to 0.10 to 0.14 inch.

TEMPERATURE OF THE AIR.

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	60.6	−2.3	+ 6.1	+1.0
Middle Atlantic	12	69.0	−1.9	− 2.7	−0.4
South Atlantic	10	77.6	+0.4	− 8.3	−1.4
Florida Peninsula	8	80.7	+1.0	− 5.0	−0.8
East Gulf	9	81.3	+2.5	− 4.1	−0.7
West Gulf	7	81.2	+2.1	+ 2.9	+0.5
Ohio Valley and Tennessee	11	72.7	−1.3	− 6.9	−1.2
Lower Lake	8	63.0	−4.1	− 0.8	−0.1
Upper Lake	10	58.3	−4.0	+11.7	+2.0
North Dakota	8	59.1	−5.4	+16.7	+2.8
Upper Mississippi Valley	11	67.9	−3.3	+ 4.3	+0.7
Missouri Valley	11	67.0	−3.6	+ 8.7	+1.4
Northern Slope	7	60.9	−2.1	+12.8	+2.1
Middle Slope	6	71.2	−0.4	+ 8.2	+1.4
Southern Slope	6	78.1	+1.9	+ 7.6	+1.3
Southern Plateau	13	74.3	+1.1	+ 1.7	+0.3
Middle Plateau	9	65.6	+1.6	+ 6.5	+1.1
Northern Plateau	12	60.6	−0.3	+ 6.5	+1.1
North Pacific	7	58.1	− 0.1	+ 2.4	+0.4
Middle Pacific	5	62.3	+0.5	− 2.1	−0.4
South Pacific	4	67.3	+0.8	− 1.4	−0.2

In the South Atlantic and Gulf States and the middle and southern parts of the slope, Plateau, and Pacific regions the temperature was above the normal, the value amounting to 4.5° in southwestern Texas; elsewhere it was below the normal, and generally the departures were greater than in the region where it was above.

Maximum temperatures of 80° or higher everywhere occurred, except about Lake Superior, the Strait of Mackinac, and on the immediate coasts of the north Pacific and northern part of the middle Pacific regions; of 90° or higher in New England, New York, northern Pennsylvania, eastern West Virginia, northeastern Ohio, the upper Lake region, except about extreme southern Lake Michigan, extreme northern Illinois, northeastern Iowa, Wisconsin, and Minnesota, generally, northern North Dakota, Montana, except the southeastern part, Wyoming, except the extreme western part, extreme northern Idaho, Washington, western Oregon, and extreme northwestern California; 100° or higher generally in the interior of the Carolinas, Georgia, the east Gulf States and

Louisiana, Texas, except the extreme southeastern part, southwestern Colorado, southeastern Utah, New Mexico, Arizona, southern California, and the interior of central California; 110° or higher in north-central Texas, western Arizona, and southeastern California, and 120° to 127° in extreme southeastern California and parts of extreme southwestern Arizona.

Freezing temperatures occurred in scattered localities in New Hampshire and northeastern New York, southeastern North Dakota, South Dakota generally, western Montana, Wyoming, northwestern Colorado, southern Idaho, west-central Utah, northern Nevada, northeastern California, and parts of the interior of Washington.

In Canada.—Prof. R. F. Stupart says:

Vancouver Island is the only part of the Dominion where the mean temperature for June was as high as the average. In the Northwest Territories and Manitoba the negative departures ranged between 5° and 8°, and in Ontario, Quebec, and the Maritime Provinces between 2° and 5°. A negative departure of about 5° in Alberta diminished westward to 3° at Kamloops, and to nil at the Strait of Georgia, and a slight positive departure occurred at Victoria.

PRECIPITATION.

Precipitation in amounts from 10.0 inches to 13.9 inches occurred in west-central Indiana, north-central Illinois, central and extreme southwestern Iowa, southeastern Kansas, and parts of southeastern Texas; and 15.0 inches in the interior of north-central Florida. No precipitation was reported from parts of southeastern California, western Arizona, west-central and southern Nevada, and the central Rio Grande Valley.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	3.94	134	+1.0	+0.2
Middle Atlantic	12	4.56	124	+0.9	−1.6
South Atlantic	10	3.13	63	−1.8	−7.4
Florida Peninsula	8	7.56	107	+0.5	−1.1
East Gulf	9	1.11	21	−4.2	−7.0
West Gulf	7	3.62	95	−0.2	−6.3
Ohio Valley and Tennessee	11	5.30	123	+1.0	−5.0
Lower Lake	8	6.10	169	+2.5	−1.0
Upper Lake	10	4.04	107	+0.3	−1.9
North Dakota	8	3.36	89	−0.4	+1.5
Upper Mississippi Valley	11	5.74	126	+1.2	−0.7
Missouri Valley	11	5.36	123	+1.0	−2.3
Northern Slope	7	2.20	85	−0.4	+0.2
Middle Slope	6	3.42	114	+0.4	+1.6
Southern Slope	6	0.84	24	−2.6	+1.4
Southern Plateau	13	0.10	25	−0.3	−1.4
Middle Plateau	8	0.19	32	−0.4	−1.1
Northern Plateau	12	0.67	46	−0.8	−1.0
North Pacific	7	1.67	74	−0.6	+2.7
Middle Pacific	5	0.06	13	−0.4	+1.5
South Pacific	4	T.	0	−0.1	−0.6

The precipitation was above the normal in New England, generally, the Middle Atlantic States, Virginia, except the southeastern part, northwestern South Carolina, north-central and extreme southern Florida, eastern and extreme southwestern Tennessee, West Virginia, Kentucky, Ohio, Indiana, lower Michigan, Illinois, except the extreme southern part, northern Arkansas, northeastern Oklahoma, eastern Kansas, Missouri, Iowa, southern Wisconsin, central South Dakota, eastern Nebraska, parts of central Colorado and southwestern Idaho, northwestern North Dakota, and northeastern Montana, the excess amounting to from 4.0 to 6.0 inches in northeastern and central Ohio, central Illinois, southwestern Missouri, southeastern Nebraska, and the extreme southern part of Florida; elsewhere it was below the normal, the deficiencies in the Gulf States and on the south Atlantic coast amounting to from 2.0 to 6.0 inches.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 3, 18, 20, 28. Arizona, 11. Arkansas, 3, 18, 19, 20, 21. California, 1, 10. Colorado, 4, 5, 11, 12, 13, 14, 15, 16, 26, 27, 28, 29, 30. Connecticut, 3. Delaware, 23, 26. Florida, 18, 20, 22. Georgia, 7, 8, 9, 14, 16, 22. Idaho, 1, 4, 5, 25, 26, 30. Illinois, 2, 3, 4, 9, 10, 11, 12, 13, 15, 25, 26, 28. Indiana, 1, 6, 7, 11, 13, 15, 25, 26, 27. Iowa, 1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 15, 18, 24, 25. Kansas, 6, 19, 20. Kentucky, 3, 7, 13, 15, 18, 25, 26, 27, 28, 30. Louisiana, 9, 11, 18, 19, 20, 21, 28. Maine, 24, 25. Maryland, 3, 13, 25, 29. Massachusetts, 3. Michigan, 12, 15, 22, 23, 24, 25, 28. Minnesota, 1, 2, 7, 8, 9, 14, 20, 21. Mississippi, 17, 18, 19, 20, 27. Missouri, 15, 18, 28. Montana, 1, 3, 4, 8, 14, 15, 16, 17, 18, 24, 25, 26, 29, 30. Nebraska, 1, 4, 5, 6, 7, 10, 11, 12, 13, 14, 16, 19, 23, 24, 26, 27, 28, 30. Nevada, 1. New Hampshire, 3, 4, 5. New Jersey, 7, 13, 14, 23, 24. New Mexico, 3, 4, 6, 10, 11, 16. New York, 2, 3, 7, 14, 15, 16, 17, 21, 23, 24, 26. North Carolina, 6, 8, 11, 12, 21. North Dakota, 1, 5, 10, 24. Ohio, 6, 7, 8, 12, 13, 14, 15, 18, 22, 23, 24, 25, 26, 28. Oklahoma, 13, 14, 15. Pennsylvania, 3, 12, 13, 16, 21, 23, 24. Rhode Island, 4. South Carolina, 4, 8, 21, 26. South Dakota, 5, 6, 12, 14, 21, 24, 30. Tennessee, 1, 5, 7, 8, 12, 13, 18, 21, 26. Texas, 2, 6, 12, 28, 29, 30. Utah, 1, 28. Vermont, 5, 24. Virginia, 12, 13, 21, 28, 30. Washington, 3, 4, 14. West Virginia, 12, 18, 19, 23, 25, 26. Wisconsin, 2, 12, 21. Wyoming, 1, 13, 15, 27, 28.

SLEET.

The following are the dates on which sleet fell in the respective States:

Idaho, 1. Minnesota, 20, 21. North Dakota, 19, 20. Ohio, 23.

In Canada.—Professor Stupart says:

In nearly all parts of the Dominion the June rainfall was in excess of the average; in Quebec, northern New Brunswick, and Manitoba it was from one-third greater to double the average, and the same is true over a large portion of Ontario. In the more central parts of Alberta, as in May, the rainfall has been phenomenal, Calgary reporting four times the average amount; this extreme excess did not, however, extend north of Wetaskiwin, and in the neighborhood of Edmonton there was even a small deficiency. In the upper mainland of British Columbia there was an excess, but in the lower mainland a deficiency, which was even more pronounced in Vancouver Island.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.3	+ 0.2	Missouri Valley	5.5	+ 0.7
Middle Atlantic	5.0	− 0.0	Northern Slope	5.1	+ 0.3
South Atlantic	4.1	− 0.8	Middle Slope	4.9	+ 1.2
Florida Peninsula	5.4	− 0.1	Southern Slope	3.6	− 0.8
East Gulf	3.2	− 1.6	Southern Plateau	1.2	− 0.7
West Gulf	3.2	− 1.4	Middle Plateau	2.4	− 0.6
Ohio Valley and Tennessee	5.2	+ 0.2	Northern Plateau	4.5	− 0.6
Lower Lake	5.7	+ 0.8	North Pacific	5.6	− 0.5
Upper Lake	6.0	+ 0.8	Middle Pacific	1.7	− 1.5
North Dakota	5.4	+ 0.2	South Pacific	2.5	− 0.8
Upper Mississippi Valley	6.0	+ 1.0			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Abilene, Tex	29	53	nw.	Pierre, S. Dak	24	67	nw.
Bismarck, N. Dak	1	52	se.	Point Reyes Light, Cal	1	58	nw.
Buffalo, N. Y	26	51	w.	Do	3	62	nw.
Chattanooga, Tenn	28	57	sw.	Do	4	55	nw.
Cleveland, Ohio	29	54	ne.	Do	11	55	nw.
Knoxville, Tenn	18	52	w.	Do	12	68	nw.
Louisville, Ky	15	58	nw.	Do	13	64	nw.
Mount Tamalpais, Cal	1	54	nw.	Do	14	65	nw.
Do	3	55	nw.	Do	15	62	nw.
Do	13	55	nw.	Do	16	76	nw.
Do	20	65	nw.	Do	17	59	nw.
Do	21	60	nw.	Do	24	66	nw.
Do	24	58	nw.	Do	25	68	nw.
Do	25	50	nw.	Do	26	72	nw.
Do	26	60	nw.	Do	27	80	nw.
Do	27	52	nw.	Do	28	62	nw.
New York, N. Y	8	72	nw.	Do	29	50	nw.
Do	13	60	nw.	St. Louis, Mo	28	54	n.
Do	26	52	nw.	Yankton, S. Dak	25	64	nw.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 6,406 thunderstorms were received during the current month as against 6,670 in 1901 and 6,425 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 13th, 402; 7th, 351; 15th, 328; 3d, 316.

Reports were most numerous from: Missouri, 454; Ohio, 434; Illinois, 414; Iowa, 373.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 16th to 24th.

In Canada: Thunderstorms were reported as follows: St. John, N. B., 2; Yarmouth, 17; Charlottetown, 2; Father Point, 16; Quebec, 2; Montreal, 24; Ottawa, 4; Kingston, 15; Toronto, 2, 12, 15, 24; Port Stanley, 2, 3, 11, 13, 15, 16, 23, 24, 25; Parry Sound, 2; Port Arthur, 2, 3, 9, 24; Winnipeg, 2, 11, 17; Minnedosa, 1, 9, 11, 19; Medicine Hat, 7, 10, 15, 16, 24; Swift Current, 1, 4, 10, 11, 30; Banff, 15, 29; Prince Albert, 22, 29.

No auroras were reported from Canada during June, 1902.

HUMIDITY.

The average by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	77	− 3	Missouri Valley	72	+ 3
Middle Atlantic	70	− 3	Northern Slope	63	+ 7
South Atlantic	75	− 3	Middle Slope	65	+ 6
Florida Peninsula	79	− 2	Southern Slope	58	− 2
East Gulf	65	−10	Southern Plateau	24	− 4
West Gulf	69	− 5	Middle Plateau	32	− 5
Ohio Valley and Tennessee	68	− 2	Northern Plateau	52	0
Lower Lake	74	+ 2	North Pacific	70	− 9
Upper Lake	74	+ 1	Middle Pacific	59	− 6
North Dakota	73	+ 5	South Pacific	65	+ 1
Upper Mississippi Valley	72	+ 1			

DESCRIPTION OF TABLES AND CHARTS.

By W. B. STOCKMAN, Forecast Official, in charge of Divison of Records and Meteorological Data.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geograpical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (ins.)	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages.

NOTES EXPLANATORY OF THE CHARTS.

Chart I, tracks of centers of high areas, and Chart II, tracks of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the

lowest barometric reading at or near the center at that time.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on page 13 of the January, 1902, Review. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900-1901.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds.

Chart IX.—The total snowfall. This is based on the reports from regular and voluntary observers, and shows the depth of the snowfall during the month in inches. In general, the depth is shown by lines inclosing areas of equal snowfall, but in special cases figures are also given.

Chart X.—Snow on ground on January 31, 1902.

TABLE I.—*Climatological data for Weather Bureau Stations, June, 1902.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.												Precipitation, in inches.			Wind.									
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							60.6	− 2.3										77	3.94	+ 1.0										5.3	
Eastport	76	69	74	29.74	29.82	− .11	54.5	− 0.6	79	17	62	41	5	47	35	50	48	84	2.51	− 1.0	16	6,704	sw.	42	e.	26	7	14	9	6.1	
Portland, Me.	103	81	117	29.71	29.83	− .12	59.4	− 3.9	88	3	68	44	1	51	28	54	49	72	3.78	+ 0.4	17	6,248	sw.	36	nw.	17	11	8	11	5.5	
Northfield	876	15	65	28.92	29.85	− .11	57.9	− 5.7	84	3	69	34	11	47	42	55	51	75	3.84	+ 0.8	16	6,357	s.	34	nw.	8	3	10	17	7.3	
Boston	125	115	181	29.73	29.87	− .09	64.3	− 2.0	92	3	74	49	9	55	33	57	53	69	1.77	− 1.3	12	7,978	w.	34	nw.	8	14	6	10	4.5	
Nantucket	12	43	85	29.88	29.89	− .09	60.6	− 0.6	73	20	66	47	1	55	21	57	54	83	6.34	+ 3.5	12	10,110	sw.	37	ne.	29	9	18	3	5.2	
Block Island	26	11	70	29.87	29.90	− .07	60.8	− 1.2	76	4	67	45	1	55	19	57	54	84	5.35	+ 2.8	14	11,293	sw.	48	e.	29	12	13	5	4.2	
Narragansett	......	10	....	......	......	......	62.8	− 1.8	83	4	72	43	1	54	27	....	....	....	3.60	+ 1.0	12	......	s.	....	....	....	19	7	4	....	
New Haven	106	117	140	29.77	29.89	− .08	64.8	− 2.5	89	3	74	47	9	56	33	58	54	71	4.35	+ 1.4	12	6,251	sw.	32	nw.	8	12	14	4	4.4	
Mid. Atlantic States.							69.0	− 1.9										70	4.56	+ 0.9										5.0	
Albany	97	102	115	29.78	29.88	− .09	64.5	− 4.5	88	3	74	48	9	55	26	58	53	69	3.91	+ 0.3	19	5,552	s.	30	se.	26	7	14	9	5.8	
Binghamton	875	79	90	28.97	29.90	− .07	62.2	− 4.1	86	3	72	39	6	52	38	....	....	....	6.84	+ 3.5	17	4,390	w.	36	s.	25	6	14	10	5.9	
New York	314	108	350	29.57	29.90	− .08	68.2	− 0.8	89	13	76	51	9	60	30	60	56	70	5.91	+ 2.8	12	9,417	nw.	72	nw.	8	9	16	5	5.1	
Harrisburg	374	94	104	29.53	29.93	− .06	69.0	− 1.5	91	13	79	49	25	59	33	....	....	....	4.76	+ 0.5	15	5,352	w.	37	nw.	13	6	16	8	5.9	
Philadelphia	117	168	184	29.80	29.91	− .07	70.4	− 1.3	94	13	80	53	9	61	32	61	56	65	6.08	+ 3.0	12	7,748	sw.	36	n.	17	12	10	8	5.1	
Scranton	805	111	119	29.06	29.91	− .07	65.0	......	89	3	75	42	6	54	39	57	52	67	6.69	......	19	5,359	nw.	39	sw.	3	7	14	9	5.8	
Atlantic City	52	39	48	29.87	29.93	− .05	65.2	− 1.6	86	4	72	50	9	59	28	61	59	84	6.14	+ 2.9	12	6,238	sw.	34	s.	26	15	13	2	3.9	
Cape May	17	47	51	29.93	29.95	− .03	65.0	− 3.2	84	4	71	53	9	59	23	61	....	....	4.93	+ 1.8	12	5,353	s.	33	nw.	16	12	13	5	4.5	
Baltimore	123	68	82	29.78	29.91	− .08	72.3	− 1.2	94	13	82	53	9	62	29	64	59	66	4.30	+ 0.3	11	5,598	nw.	30	nw.	26	5	15	10	5.6	
Washington	112	59	76	29.81	29.93	− .07	71.8	− 1.4	94	13	82	46	24	61	28	64	58	65	3.70	− 0.3	11	4,954	nw.	32	nw.	29	14	11	5	4.1	
Cape Henry	......	5	58	29.95	29.96	− .04	72.4	− 0.7	97	13	80	52	10	64	27	....	....	....	1.35	− 2.6	11	9,242	s.	40	nw.	8	12	10	8	....	
Lynchburg	681	83	88	29.22	29.93	− .08	72.5	− 1.7	96	13	84	49	10	61	38	63	58	63	3.89	+ 0.4	6	3,416	nw.	28	nw.	12	6	17	7	5.1	
Norfolk	91	102	111	29.85	29.95	− .05	74.5	− 0.6	94	13	84	54	10	66	28	68	66	79	2.88	− 1.4	10	7,171	s.	49	w.	26	16	11	3	3.7	
Richmond	144	82	90	29.81	29.96	− .05	74.3	......	96	13	85	52	10	64	31	....	....	....	4.81	......	7	4,544	sw.	34	sw.	29	11	10	9	4.9	
S. Atlantic States.							77.6	+ 0.4										75	3.13	− 1.8										4.1	
Charlotte	773	68	76	29.14	29.95	− .06	76.5	+ 0.7	98	12	87	57	24	66	27	67	63	68	4.07	− 0.5	13	4,976	sw.	36	w.	26	13	12	5	4.4	
Hatteras	11	18	47	29.97	29.98	− .03	75.4	+ 1.4	86	28	80	62	9	71	13	70	68	81	2.66	− 1.9	8	8,573	sw.	47	w.	16	12	10	8	4.6	
Kittyhawk	8	12	30	......	......	......	74.0	− 0.2	94	29	82	58	10	66	28	....	....	....	1.68	− 2.9	5	9,495	sw.	....	....	....	20	5	5	3.4	
Raleigh	376	93	101	29.56	29.95	− .06	76.4	+ 0.7	96	12	86	57	24	66	29	68	64	71	3.04	− 0.9	12	4,801	sw.	26	sw.	29	17	8	5	4.2	
Wilmington	78	82	90	29.88	29.97	− .04	76.4	− 0.3	95	30	84	57	10	68	25	70	67	78	3.17	− 2.5	11	6,326	sw.	41	s.	16	9	19	2	4.3	
Charleston	48	14	92	29.93	29.97	− .04	79.6	+ 0.5	99	30	86	67	9	73	22	73	70	76	1.82	− 3.8	14	8,506	s.	42	n.	8	7	22	1	4.4	
Columbia	351	114	122	29.60	29.96	− .05	78.4	− 0.6	98	30	89	60	23	68	27	69	65	70	4.43	+ 0.3	10	6,098	sw.	42	w.	7	12	15	3	4.5	
Augusta	180	89	97	29.76	29.96	− .03	79.4	+ 0.6	100	30	89	64	8	70	28	70	67	70	4.55	0.0	8	4,744	se.	45	ne.	8	16	12	2	3.7	
Savannah	65	79	89	29.90	29.97	− .04	79.9	+ 0.6	99	30	88	66	10	72	25	74	72	82	2.19	− 4.4	8	6,147	sw.	36	sw.	15	17	10	3	3.6	
Jacksonville	43	69	84	29.90	29.95	− .06	80.3	+ 0.2	98	30	89	65	8	72	29	73	70	75	3.65	− 1.8	11	5,829	sw.	42	sw.	15	12	15	3	3.8	
Florida Peninsula.							80.4	− 0.1										79	6.65	+ 0.1										5.4	
Jupiter	28	10	30	29.93	29.96	− .05	80.4	+ 1.4	90	14	86	71	9	75	16	76	74	82	3.92	− 2.6	10	8,849	e.	48	sw.	13	10	14	6	5.1	
Key West	22	43	50	29.90	29.92	− .07	80.8	− 1.7	88	29	85	70	1	77	13	75	73	79	9.59	+ 5.6	13	6,915	e.	26	ne.	1	8	9	13	6.2	
Tampa	34	60	67	29.92	29.95	− .06	80.1	+ 0.1	93	18	89	66	7	72	24	73	70	77	6.43	− 2.8	12	5,254	ne.	36	s.	14	8	17	5	5.0	
East Gulf States.							81.3	+ 2.5										60	1.11	− 4.2										3.2	
Atlanta	1,174	190	216	28.75	29.96	− .05	78.0	+ 2.3	96	12	88	58	23	68	26	67	61	62	2.00	− 1.9	7	8,590	se.	38	nw.	18	12	15	3	3.9	
Macon	370	93	99	29.58	29.96	− .05	80.0	......	99	30	90	62	23	70	28	....	....	....	2.16	......	7	4,901	sw.	34	nw.	18	13	13	4	4.4	
Pensacola	56	78	96	29.90	29.96	− .03	81.6	+ 2.2	96	15	88	68	23	76	20	....	....	....	1.41	− 4.0	1	7,925	sw.	34	sw.	29	16	14	0	3.4	
Mobile	57	88	96	29.89	29.95	− .04	82.0	+ 2.3	98	15	90	64	23	74	24	73	70	71	0.53	− 5.4	5	5,646	sw.	26	s.	28	26	4	0	2.2	
Montgomery	223	100	112	29.70	29.92	− .08	82.2	+ 2.8	99	18	93	60	23	71	30	70	64	59	1.57	− 3.1	5	5,121	sw.	33	ne.	20	20	8	2	3.2	
Meridian	375	84	93	29.56	29.94	− .04	80.6	+ 3.0	97	18	93	52	23	68	35	....	....	....	0.22	− 6.0	2	4,075	sw.	28	se.	18	23	5	2	2.1	
Vicksburg	247	62	74	29.66	29.92	− .05	81.6	+ 2.4	97	11	91	60	23	72	25	72	67	65	0.61	− 3.7	3	4,773	sw.	30	s.	28	21	6	3	3.0	
New Orleans	51	88	121	29.89	29.94	− .04	82.9	+ 2.6	95	9	91	69	23	75	21	74	70	70	1.46	− 5.2	7	6,035	s.	30	se.	27	21	7	2	3.1	
Port Eads	......	27	....	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	......	......	....	......	....	....	....	....	....	....	....	....	
West Gulf States.							81.2	+ 2.1										69	3.62	− 0.2										3.2	
Shreveport	249	77	84	29.64	29.90	− .06	81.7	+ 1.8	100	19	93	58	23	71	32	72	68	68	8.34	+ 4.6	3	5,050	s.	38	se.	28	23	5	2	2.3	
Fort Smith	457	79	94	29.40	29.86	− .08	79.2	+ 3.1	98	25	90	54	22	69	30	69	65	65	1.66	− 2.7	6	6,978	e.	46	sw.	27	7	23	0	4.0	
Little Rock	357	93	100	29.54	29.90	− .06	78.6	+ 1.6	96	11	88	57	23	70	23	70	66	68	4.08	− 0.3	10	5,342	s.	46	sw.	28	17	13	0	3.4	
Corpus Christi	20	48	53	29.85	29.86	− .05	81.8	+ 1.9	95	27	86	72	9	77	21	75	73	78	1.44	− 1.2	3	10,240	se.	36	nw.	26	20	8	2	3.4	
Fort Worth	670	106	114	29.17	29.87	− .05	83.2	......	103	25	94	58	22	72	30	....	....	....	0.58	......	5	10,939	s.	48	nw.	18	25	3	2	2.2	
Galveston	54	106	112	29.83	29.88	− .07	82.2	+ 0.6	88	10	86	69	22	79	17	75	72	74	8.22	+ 3.4	5	9,315	se.	49	se.	27	25	2	3	2.4	
Palestine	510	73	79	29.36	29.88	− .06	81.0	+ 2.8	97	19	91	59	23	71	29	71	67	68	1.57	− 2.7	3	6,671	s.	39	s.	27	18	10	2	3.3	
San Antonio	701	80	91	29.13	29.84	− .06	83.8	+ 3.1	103	28	95	68	10	73	27	71	66	62	0.02	− 2.6	2	6,684	se.	24	se.	29	11	18	1	4.5	
Taylor	583	55	63	29.27	29.87	− .05	82.7	......	99	19	94	66	23	72	30	....	....	....	1.04	......	2	9,216	s.	39	se.	29	19	9	2	3.2	
Ohio Val. and Tenn.							72.7	− 1.3										68	5.30	+ 1.0										5.2	
Chattanooga	762	106	112	29.18	29.97	− .03	77.8	+ 2.6	100	12	89	57	10	67	33	67	62	61	1.33	− 3.2	9	5,021	ne.	57	sw.	28	9	16	5	4.9	
Knoxville	1,004	10	88	28.93	29.97	− .03	74.9	+ 1.3	99	12	87	52	23	63	32	66	61	69	5.45	+ 1.4	11	5,386	sw.	52	w.	18	11	13	6	4.7	
Memphis	397	140	154	29.52	29.94	− .03	78.3	+ 0.2	96	12	87	57	22	70	26	71	67	70	5.27	+ 0.6	7	6,736	sw.	40	sw.	28	17	7	6	3.6	
Nashville	546	122	131	29.38	29.96	− .03	76.4	− 0.2	98	12	87	53	10	66	34	67	62	65	2.77	− 1.5	12	4,733	n.	37	sw.	25	12	13	5	4.6	
Lexington	989	75	102	28.91	29.96	− .04	71.2	− 2.6	92	12	80	50	9	62	30	....	....	....	5.19	+ 0.9	12	6,265	se.	40	nw.	27	13	13	4	4.6	
Louisville	525	114	136	29.38	29.97	− .01	73.4	− 1.7	97	12	83	53	23	64	31	65	60	66	6.51	+ 2.2	13	5,607	s.	58	nw.	15	10	10	10	4.9	
Evansville	431	72	82	29.46	29.92	− .05	74.8	......	97	12	84	52	22	66	26	....	....	....	3.17	......	13	5,146	s.	45	sw.	28	8	15	7	5.3	
Indianapolis	822	154	164	29.06	29.94	− .03	69.5	− 3.0	93	12	79	49	23	60	26	62	58	70	7.52	+ 2.9	13	4,961	s.	37	sw.	7	9	13	8	5.3	
Cincinnati	628	152	157	29.27	29.94	− .05	71.8	− 2.0	94	12	81	52	23	63	25	63	58	67	5.25	+ 0.8	15	5,130	se.	36	w.	29	7	11	12	5.7	
Columbus	824	87	100	29.07	29.94	− .05	68.2	− 3.1	94	12	78	46	23	58	29	61	56	69	8.52	+ 5.0	13	8,159	sw.	48	sw.	25	6	15	9	6.1	
Pittsburg	842	116	123	29.04	29.92	− .07	68.4	− 3.2	90	13	77	49	24	60	31	60	55	65	5.79	+ 2.3	13	4,149	nw.	24	s.	25	7	16	7	5.5	
Parkersburg	638	77	84	29.29	29.97	− .03	69.8	− 2.7	93	12	80	49	9	60	31	63	59	72	4.72	− 0.2	18	3,711	s.	49	w.	12	9	10	11	5.8	
Elkins	1,940	41	50	27.95	29.95	− .05	63.0	......	90	14	76	36	9	50	40	59	56	79	5.22	......	17	3,000	w.	34	w.	12	4	15	11	6.3	
Lower Lake Region.							63.0	− 4.1										74	6.10	+ 2.6										5.7	
Buffalo	767	178	206	29.07	29.89	− .08	61.4	− 3.6	84	1	68	45	9	55	29	56	52	72	4.20	+ 0.7	17	10,630	w.	51	w.	26	2	14	14	6.8	
Oswego	335	76	91	29.51	29.87	− .10	58.8	− 5.2	83	15	66	42	9	51	30	55	51	78	4.54	+ 1.1	18	6,818	w.	28	w.	26	4	14	12	6.2	
Rochester	523	81	90	29.33	29.89	− .08	62.0	− 4.4	85	1	70	41	9	54	38	56	53	74	4.08	+ 0.9	16	6,851	sw.	35	w.	21	5	17	8	5.7	
Erie	713	92	102	29.15	29.92	− .06	62.5	− 4.5	84	1	69	44	9	56	27	58	55	77	4.16	+ 0.2	16	7,230	w.	39	s.	25	5	16	9	5.7	
Cleveland	762	190	201	29.11	29.92	− .06	64.4	− 3.4	87	15	72	48	23	57	29	58	55	73	9.77	+ 6.0	20	9,785	se.	54	ne.	29	6	17	7	6.0	
Sandusky	629	62	70	29.26	29.94	− .04	65.6	− 3.4	91	15	74	47	22	58	28	....	....	....	8.85	+ 4.9	15	6,168	sw.	32	nw.	25	14	11	5	4.0	
Toledo	628	123	127	29.25	29.93	− .04	65.2	− 4.6	91	15	74	44	23	56	29	58	54	70	6.19	+ 2.8	13	7,451	sw.	38	ne.	29	10	15	5	5.0	
Detroit	730	153	193	29.13	29.92	− .05	63.9	− 4.0	84	15	73	46	9	55	28	57	54	76	6.97	+ 3.3	18	8,294	w.	48	nw.	12	5	16	9	6.0	
Upper Lake Region.							58.3	− 4.0										74	4.04	+ 0.3										6.0	
Alpena	609	63	80	29.24	29.90	− .06	55.8	− 4.5	79	2	65	39	5	47	31	51	47	75	3.14	− 0.6	15	7,834	se.	34	nw.	26	5	13	12	6.4	
Escanaba	612	43	57	29.23	29.89	− .05	56.6	− 3.9	81	11	66	37	5	48	33	52	47	73	2.56	− 1.3	13	5,922	s.	36	nw.	21	4	17	9	6.1	
Grand Haven	632	54	92	29.23	29.90	− .06	60.4	− 4.0	82	12	68	45	5	53	26	56	53	80	3.85	0.0	17	8,095	w.	38	sw.	3	8	12	10	5.7	
Houghton	668	66	74	29.16	29.88	− .06	55.7	......	75	1	65	37	5	46	33	....	....	....	2.25	......	11	5,744	w.	30	w.	11	10	12	8	5.1	
Marquette	734	79	116	29.10	29.91	− .03	54.2	− 4.8	78	15	62	35	5	46	32	49	44	70	2.98	− 0.5	14	6,894	nw.	40	nw.	21	4	16	10	6.0	T.
Port Huron	638	70	120	29.24	29.94	− .03	60.4	− 3.7	83	2	70	41	9	51	32	56	53	78	5.30	+ 1.8	18	7,933	n.	35	nw.	2	4	12	14	6.7	
Sault Ste. Marie	614	40	61	29.20	29.86	− .10	53.2	− 7.0	75	2	61	36	5	45	28	49	45	75	3.04	0.0	13	6,992	nw.	40	nw.	26	9	12	9	5.5	
Chicago	823	241	274	29.05	29.93	− .03	64.2	− 2.5	91	12	72	48	21	57	34	58	55	78	6.45	+ 2.6	16	10,902	ne.	45	ne.	29	7	16	7	5.4	
Milwaukee	681	124	142	29.20	29.93	− .02	61.8	− 1.5	85	2	71	46	5	53	36	56	52	77	4.71	+ 0.6	14	6,854	w.	38	s.	2	6	13	11	6.1	
Green Bay	617	49	57	29.23	29.90	− .05	61.4	− 5.3	85	11	71	41	22	52	33	55	50	69	4.71	+ 1.0	15	7,194	sw.	46	sw.	2	3	13	14	6.8	
Duluth	702	95	116	29.14	29.90	− .02	55.2	− 2.6	80	9	64	39	4	46	29	49	44	70	3.68	− 0.9	11	6,261	ne.	36	w.	2	5	18	7	6.1	
North Dakota.							58.5	− 5.5										73	3.59	− 0.2										5.4	
Moorhead	935	54	60	28.92	29.92	+ .02	59.8	− 5.0	92	9	70	36	21	50	38	55	51	74	3.22	− 1.1	16	6,031	nw.	34	w.	3	7	8	15	6.4	
Bismarck	1,674	16	29	28.17	29.94	+ .07	58.2	− 5.6	90	9	68	34	21	48	37	53	49	74	3.63	+ 0.1	17	7,392	se.	52	se.	1	15	5	10	5.1	
Williston	1,875	15	31	27.93	29.88	+ .02	57.5	− 5.8	86	9	67	39	18	48	33	52	48	72	3.92	+ 0.4	13	7,006	n.	48	nw.	17	17	8	5	4.7	

TABLE I.—*Climatological data for Weather Bureau Stations, June, 1902*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Maximum velocity: Direction.	Maximum velocity: Date.					
Upper Miss. Valley.							67.9	− 3.3										72	5.74	+ 1.2										6.0	
Minneapolis		99	208				64.1	− 4.7	86	9	73	44	21	55	30				2.00	− 1.8	12	8,116	w.	40	w.	20	1	14	15		
St. Paul	837	114	124	29.00	29.90	− .02	64.1	− 3.1	84	9	72	45	21	56	28	57	52	68	2.49	− 1.9	9	5,536	nw.	33	nw.	20	5	14	11	5.9	
La Crosse	714	71	87	29.15	29.92	− .01	64.2	− 4.7	81	11	73	44	22	56	25				2.63	− 1.8	14	5,230	s.	34	nw.	2	8	15	7	5.4	
Davenport	606	71	79	29.25	29.89	− .05	66.3	− 4.6	90	12	75	46	21	58	25	60	57	74	7.55	+ 3.2	18	5,237	nw.	34	sw.	12	8	14	8	5.8	
Des Moines	861	84	88	29.02	29.93	+ .01	65.8	− 4.3	90	10	74	43	22	57	26	60	57	75	7.27	+ 1.9	17	5,830	sw.	32	ne.	10	4	13	13	6.4	
Dubuque	698	100	117	29.18	29.92	− .01	65.0	− 4.5	88	12	73	45	22	57	25	59	54	68	6.97	+ 1.8	15	4,789	nw.	34	sw.	12	4	10	16	7.1	
Keokuk	614	63	78	29.24	29.88	− .06	68.4	− 4.1	93	12	77	46	22	60	29	63	60	77	7.59	+ 3.0	15	5,026	n.	36	n.	10	4	16	10	6.0	
Cairo	356	87	93	29.55	29.93	− .04	75.7	+ 0.3	95	11	84	55	22	67	25	68	64	71	2.47	− 2.0	10	5,895	s.	44	sw.	28	7	12	11	5.7	
Springfield, Ill	644	82	93	29.23	29.91	− .04	69.4	− 2.8	94	12	79	47	22	60	35	63	60	74	10.10	+ 5.6	15	6,311	sw.	42	n.	10	8	8	14	6.2	
Hannibal	534	75	110	29.33	29.90	− .05	69.4	− 3.0	93	11	78	44	22	61	30				6.22	+ 2.9	13	6,204	s.	37	sw.	13	6	12	12	6.1	
St. Louis	567	111	210	29.31	29.91	− .04	74.2	− 1.0	98	11	83	53	22	66	28	66	63	71	7.86	+ 2.8	14	6,332	s.	54	n.	28	10	12	8	5.3	
Missouri Valley.							67.0	− 3.6										72	5.36	+ 1.0										5.5	
Columbia	784	11	84	29.09	29.91	− .04	69.8	− 4.5	94	11	79	43	22	61	31				6.56	+ 1.7	14	5,296	s.	26	sw.	6	7	9	14	6.4	
Kansas City	963	78	95	28.90	29.92	.00	70.4	− 3.0	95	11	78	50	22	63	24	63	59	72	4.20	− 0.8	14	6,042	s.	30	s.	1	7	10	13	6.0	
Springfield, Mo	1,324	98	104	28.53	29.91	− .04	71.6	− 0.8	93	11	80	50	22	64	26	67	64	80	9.12	+ 4.7	12	7,384	s.	34	n.	28	15	9	6	4.3	
Topeka		81	89				69.8	− 3.4	96	10	78	49	22	61	26				4.64	− 0.2	11	6,947	s.	34	s.	2	7	13	10	5.8	
Lincoln	1,189	75	84	28.61	29.85	− .05	66.8	− 4.3	96	10	76	43	21	58	41	61	57	75	8.83	+ 4.6	14	7,467	s.	45	n.	14	10	11	9	5.5	
Omaha	1,105	115	121	28.72	29.88	− .03	67.3	− 4.2	95	10	76	46	21	59	29	61	57	73	7.32	+ 1.6	16	5,870	se.	36	nw.	14	5	13	12	6.0	
Valentine	2,598	39	40	27.19	29.86	.00	63.6	− 3.6	100	10	75	32	21	52	40	56	51	66	1.89	− 1.6	13	7,512	e.	39	s.	17	9	12	9	5.1	
Sioux City	1,135	96	164	28.70	29.90	.00	65.6	− 4.7	94	14	75	41	21	56	34				2.22	− 1.6	15	8,933	ne.	48	w.	14	8	10	12	5.8	
Pierre	1,572	43	50	28.24	29.88	+ .01	65.2	− 3.0	100	9	75	38	21	55	40	56	49	61	5.60	+ 2.2	15	6,282	se.	67	nw.	24	5	13	12	6.0	
Huron	1,306	56	67	28.54	29.92	+ .04	61.8	− 4.9	92	9	73	32	21	51	37	57	54	76	3.55	0.0	8	7,298	se.	37	nw.	24	8	18	4	5.2	
Yankton	1,233	42	49	28.59	29.90	+ .01	65.4	− 3.2	94	14	76	40	21	54	35				5.03	+ 0.8	12	5,466	nw.	64	nw.	25	12	14	4	4.4	
Northern Slope.							60.9	− 2.1										63	2.20	− 0.4										5.1	
Havre	2,505	46	53	27.29	29.91	+ .06	57.2	− 4.1	88	9	68	35	2	46	39	50	45	70	3.80	+ 0.8	12	6,142	ne.	36	nw.	16	9	19	2	4.6	0.2
Miles City	2,371	42	50	27.39	29.85	.00	62.6	− 4.4	95	9	75	36	20	50	44	58	55	77	2.21	− 0.8	10	4,027	w.	48	w.	1	12	10	8	4.7	
Helena	4,110	88	94	25.75	29.89	+ .01	57.0	− 2.4	87	9	68	32	20	46	38	46	36	51	0.46	− 2.0	8	5,696	sw.	36	sw.	2	6	10	14	6.3	
Kalispell	2,965	45	51	26.88	29.91	+ .02	54.4		83	8	67	32	6	42	42	46	39	64	1.51		9	4,352	w.	25	w.	24	12	17	1	4.0	
Rapid City	3,234	46	50	26.55	29.86	+ .01	60.5	− 3.7	91	9	71	35	21	50	37	54	49	67	2.96	− 0.9	12	5,847	nw.	42	s.	1	13	8	9	4.8	
Cheyenne	6,088	56	64	23.99	29.83	− .01	61.0	+ 0.1	92	24	75	37	20	47	40	49	40	55	1.55	0.0	10	7,631	s.	43	s.	13	7	11	12	6.1	
Lander	5,372	26	36	24.59	29.83	− .02	61.6	+ 1.5	91	9	78	31	3	46	51	48	37	48	0.93	− 0.2	4	3,286	sw.	35	ne.	27	9	18	3	4.9	
North Platte	2,821	43	52	27.01	29.87	+ .01	66.4	− 1.5	102	10	76	40	21	56	38	59	54	69	3.46	0.0	10	6,607	se.	33	ne.	14	8	13	9	5.5	
Middle Slope.							71.2	− 0.4										65	3.42	+ 0.4										4.9	
Denver	5,291	79	151	24.69	29.83	− .01	67.4	+ 1.0	98	24	82	43	20	53	40	54	44	56	1.89	+ 0.5	6	6,294	sw.	36	sw.	1	11	13	6	4.9	
Pueblo	4,685	80	86	25.21	29.79	− .04	69.8	+ 1.5	100	24	84	47	17	55	48	55	44	50	1.04	− 0.2	6	5,478	se.	46	nw.	5	9	18	3	4.6	
Concordia	1,398	42	47	28.42	29.86	− .04	69.0	− 3.3	98	10	78	45	21	60	33	62	59	76	7.34	+ 3.2	13	5,675	s.	42	n.	18	8	13	9	5.8	
Dodge	2,509	44	52	27.28	29.83	− .04	71.1	− 1.5	97	10	82	50	22	60	31	63	59	71	2.49	− 0.8	8	9,370	se.	38	se.	1	13	12	5	4.6	
Wichita	1,358	78	85	28.47	29.86	− .05	72.8	− 1.1	96	10	82	52	21	64	26	65	62	72	7.11	+ 2.1	11	7,033	s.	42	n.	20	9	16	5	5.0	
Oklahoma	1,214	54	62	28.58	29.83	− .08	77.0	+ 1.2	99	25	87	50	22	68	30	67	63	66	0.65	− 2.1	6	8,284	s.	34	s.	2	9	19	2	4.4	
Southern Slope.							77.4	+ 2.0										58	1.50	− 1.6										3.6	
Abilene	1,738	45	54	28.04	29.79	− .09	81.7	+ 3.3	106	25	93	56	22	70	35	67	61	55	1.00	− 2.2	5	8,869	se.	53	nw.	29	13	15	2	3.9	
Amarillo	3,676	43	52	26.12	29.75	− .10	73.0	+ 0.6	105	24	86	46	22	60	40	61	55	61	2.01	− 1.0	4	11,173	sw.	42	nw.	28	16	12	2	3.4	
Southern Plateau.							76.6	+ 1.4										24	0.11	− 0.2										1.2	
El Paso	3,762	10	110	26.05	29.68	− .07	82.2	+ 2.0	105	25	98	55	3	67	44	56	34	25	0.01	− 0.4	1	7,902	nw.	49	ne.	30	25	5	0	1.6	
Santa Fe	7,013	47	50	23.26	29.71	− .10	68.7	+ 3.6	90	24	81	44	2	56	31	49	31	29	0.34	− 0.6	3	5,268	se.	28	se.	4	26	4	0	1.5	
Flagstaff	6,907	12	25	23.34	29.73	− .05	62.2	0.0	92	24	81	24	2	43	49	46			0.16	− 0.2	1		sw.				19	11	0	2.0	
Phoenix	1,108	50	56	28.57	29.68	− .06	86.4	+ 2.6	116	24	103	55	2	70	44	57	31	16	0.12	0.0	1	3,449	e.	19	s.	30	28	2	0	0.8	
Yuma	141	16	50	29.52	29.66	− .08	85.0	+ 0.2	116	24	102	56	3	68	42	63	48	35	T.	0.0	0	4,261	s.	24	s.	25	28	2	0	0.4	
Independence	3,910	51	58	25.85	29.74	− .04	75.4	0.0	99	23	90	39	1	61	34	51	24	16	0.01	0.0	1	6,356	nw.	36	nw.	26	28	2	0	0.7	
Middle Plateau.							67.4	+ 1.8										32	0.12	− 0.4										2.4	
Carson City	4,720	82	92	25.22	29.84	− .02	62.1	+ 0.9	90	20	78	30	2	46	41	47	35	42	T.	− 0.4	0	4,999	w.	27	w.	23	25	5	0	1.3	
Winnemucca	4,344	59	70	25.53	29.84	− .04	64.1	+ 1.7	93	21	81	29	2	48	42	48	34	39	0.09	− 0.7	1	6,329	sw.	42	sw.	23	15	7	8	4.1	
Modena	5,479	10	38	24.54	29.75	− .07	67.6		95	24	86	31	2	49	47	45	17	18	0.02		1	8,654	sw.	43	s.	11	27	0	3	1.3	
Salt Lake City	4,366	105	110	25.52	29.79	− .06	69.4	+ 2.5	98	22	82	42	2	57	43	51	35	31	0.37	− 0.4	4	4,826	nw.	35	n.	13	19	9	2	2.8	T.
Grand Junction	4,608	43	51	25.24	29.74	− .09	74.0	+ 1.9	101	24	91	40	2	57	41	52	34	28	0.04	− 0.3	2	4,449	nw.	32	sw.	11	21	7	2	2.4	
Northern Plateau.							62.7	− 0.3										52	0.57	− 0.7										4.5	
Baker City	3,471	53	58	26.40	29.95	.00	57.8	+ 1.1	90	8	70	35	2	45	39	46	35	50	0.53	− 1.0	3	4,177	nw.	21	nw.	9	8	10	12	5.6	
Boise	2,739	61	68	27.08	29.90	− .01	64.6	− 1.1	95	9	79	39	17	50	39	50	37	45	1.08	+ 0.3	2	3,234	nw.	25	sw.	13	15	11	4	4.0	
Lewiston	757	52	61	29.12	29.93	− .01	65.6	− 0.2	95	23	79	42	2	52	39				0.65	− 0.4	4	3,138	e.	33	nw.	23	15	7	8	3.9	
Pocatello	4,482	46	54	25.40	29.83	− .04	63.1	+ 1.1	94	23	78	37	1	49	40	49	37	43	0.60	− 0.5	3	6,211	se.	35	w.	13	14	15	1	3.5	
Spokane	1,943	99	107	27.92	29.95	+ .01	60.7	− 1.7	87	22	72	40	5	49	37	49	38	51	0.45	− 1.2	7	4,582	sw.	28	sw.	23	4	15	11	6.3	
Walla Walla	1,000	65	73	28.88	29.95	− .01	64.6	− 1.0	92	8	77	43	5	52	38	58	53	69	0.11	− 1.3	3	4,178	s.	25	w.	23	13	17	0	3.8	
N. Pac. Coast Reg.							58.1	− 0.1										70	1.67	− 0.6										5.6	
Neah Bay	50	7	50	29.97	30.01	− .01	54.4	− 1.6	78	20	60	42	5	49	25	51	48	81	3.43	− 1.4	13	6,302	w.	32	e.	20	7	5	18	6.7	
Port Crescent	259	13	20	29.78	30.02	− .01	53.0	− 0.7	78	20	61	35	3	45	38				0.67	− 0.9	10	3,561	w.	22	w.	8	4	19	7	5.3	
Seattle	123	114	151	29.91	30.04	+ .04	60.6	+ 1.2	84	20	69	44	4	52	28	52	46	64	1.71	+ 0.1	9	4,777	s.	24	w.	3	7	16	7	5.2	
Tacoma	213	113	120	29.80	30.02	− .01	59.1	+ 0.9	86	20	68	42	3	50	33				1.87	+ 0.1	9	4,174	n.	22	nw.	8	8	12	10	5.6	
Astoria	20	57	64				57.6	0.0	86	20	66	44	4	50	32				2.80	− 0.3	10		sw.				6	14	10	6.1	
Portland, Oreg	154	203	213	29.86	30.02	− .02	61.4	− 0.2	86	20	71	43	17	52	34	53	47	65	0.80	− 1.0	11	4,213	nw.	32	s.	1	8	12	10	6.0	
Roseburg	518	56	67	29.45	30.00	− .02	60.7	− 0.3	89	20	73	42	14	48	37	53	48	70	0.38	− 0.9	4	3,071	n.	17	ne.	30	13	14	3	4.3	
Mid. Pac. Coast Reg.							62.3	+ 0.5										59	0.06	− 0.4										1.7	
Eureka	62	62	80	29.96	30.03	− .02	54.8	+ 0.1	66	23	59	45	17	51	16	51	48	81	0.27	− 0.9	2	6,076	nw.	39	n.	30	17	10	3	3.4	
Mount Tamalpais	2,375	11	18	27.46	29.90	− .05	65.0		84	19	73	40	1	57	30	50	36	50	0.00		0	14,268	nw.	65	nw.	20	29	1	0	0.5	
Red Bluff	332	50	56	29.47	29.82	− .06	77.0	+ 2.4	100	19	91	50	2	63	35	57	41	32	0.00	− 0.5	0	3,959	n.	25	n.	28	26	4	0	1.4	
Sacramento	69	106	117	29.74	29.81	− .08	70.6	+ 2.0	99	19	85	46	2	56	37	59	51	56	0.01	− 0.2	1	6,121	s.	28	nw.	28	27	2	1	1.3	
San Francisco	155	161	167	29.75	29.91	− .05	56.9	− 1.5	73	29	64	48	7	50	22	52	50	85	0.00	− 0.2	0	10,022	w.	40	w.	24	27	3	0	1.2	
Point Reyes Light	490	7	30	29.36	29.87		52.3	− 0.7	65	19	57	46	17	48	18				0.00	− 0.4	0	25,063	nw.	80	nw.	27	22	5	3	2.5	
S. Pac. Coast Reg.							67.3	+ 0.8										65	T.	− 0.1										2.5	
Fresno	330	67	70	29.44	29.77	− .08	78.2	+ 4.2	108	9	96	45	2	61	42	52	39	32	T.	− 0.1	0	5,747	nw.	23	nw.	23	28	2	0	0.5	
Los Angeles	338	74	82	29.48	29.84	− .06	66.4	+ 0.7	94	23	77	48	2	56	35	58	55	77	T.	− 0.1	0	3,119	w.	15	w.	2	10	19	1	3.6	
San Diego	87	94	102	29.76	29.86	− .06	62.2	− 1.9	76	24	66	52	2	58	18	58	56	81	T.	− 0.1	0	4,257	sw.	19	sw.	26	21	6	3	3.4	
San Luis Obispo	201	10	46	29.69	29.92	− .03	62.5	+ 0.1	93	22	76	40	5	49	42	54	49	71	T.	− 0.1	0	3,912	w.	18	w.	1	24	3	3	2.4	
West Indies.																															
Basseterre	29	41	54																												
Bridgetown	30	57	65	29.90	29.92	− .05	81.1	+ 2.5	88	2	86	74	20	76	14	76	74	78	5.13	+ 0.3	20	7,352	e.	24	e.	30	5	8	17	6.7	
Cienfuegos	52	62	67	29.84	29.89	− .05	81.1		94	16	88	70	3	74	20	75	73	82	3.92		17	5,098	ne.	25	sw.	20	5	14	11	6.4	
Grand Turk	11	6	20	29.94	29.95	− .06	82.8		92	*	89	73	6	77	17				1.48		9		e.				0	19	11	6.5	
Havana	57	87	105	29.85	29.91	− .04	80.0	− 1.2	92	28	85	72	11	74	17	76	74	86	10.27	+ 3.1	13	9,033	e.	43	e.	23	2	13	15	7.1	
Kingston	286	38	52																												
Port of Spain	40	65	66																												
Puerto Principe	352	55	62	29.57	29.93	− .02	80.4		93	15	89	68	26	72	24	75	73	87	15.75		23	4,521	ne.	27	e.	14	4	7	19	7.1	
Roseau	25	37	47																												
San Juan	82	48	90	29.87	29.95	− .04	79.4		91	4	84	71	16	74	15	76	74	86	12.22	+ 7.4	22	8,407	se.	30	e.	1	7	7	16	6.5	
Santiago de Cuba	82	46	52	29.81	29.89	− .05	79.7		91	24	87	68	28	72	22	75	73	83	5.36		18	3,571	se.	30	ne.	28	2	16	12	7.0	
Santo Domingo	57	37	44																												
Willemstad	75	39	46																												

NOTE.—The data at stations having no departures are not used in computing the district averages. * More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, June, 1902.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
	°	°	°	Ins.	Ins.
Alabama.					
Ashville	101	47	78.0	0.99	
Benton				0.35	
Bermuda	102	56	82.5	1.00	
Birmingham	99	55	81.2	1.76	
Bridgeport				1.90	
Burkville				0.75	
Calera				0.06	
Citronelle	100	60	82.6	0.21	
Clanton	96	56	80.7	0.27	
Cordova	102	50	79.8	1.00	
Daphne	99[f]	64[f]	81.4[f]	1.50	
Decatur	106	55	80.5	3.69	
Demopolis				1.16	
Dothan				2.31	
Elba	102	54	81.4	2.40	
Eufaula [a]	101	58	81.4	3.20	
Eutaw	100	60	82.8	0.61	
Evergreen	100	57	82.8	0.21	
Florence [a]				3.74	
Florence [b]	101	50	79.6	4.02	
Fort Deposit	99	60	82.4	1.50	
Gadsden	102	53	81.0	0.71	
Goodwater	101	55	81.0	0.44	
Greensboro	99	59	82.8	0.35	
Greenville				0.70	
Hamilton	100	50	79.5	1.32	
Helena				1.60	
Highland Home	99	62	81.8	0.33	
Letohatchie				0.05	
Livingston [a]	99	57	79.4	2.45	
Lock No. 4	103	54	80.9	1.15	
Madison Station	102	52	79.3	1.15	
Maplegrove	105	48	78.4	0.63	
Marion	100	64	84.0	0.44	
Mount Willing	102	66	84.0	T.	
Newbern	104	55	83.8	0.68	
Notasulga				0.24	
Oneonta	95	55	77.6	1.51	
Opelika	99	60	81.1	1.14	
Oxanna	100	54	80.8	0.24	
Ozark	100	59	81.7	1.30	
Prattville	100	50	81.4	T.	
Pushmataha	100	55	81.5	1.15	
Riverton	100	48	77.8	3.92	
Scottsboro	98	50	76.8	1.45	
Selma	101	59	83.4	0.63	
Talladega	102	61	82.2	0.83	
Tallassee				0.52	
Thomasville	103	57	83.8	T.	
Tuscaloosa	103	55	81.4	1.41	
Tuscumbia	101	54	79.6	4.81	
Tuskegee	101	60	82.6	0.57	
Union Springs	103	60	82.8	3.62	
Uniontown	100	50	82.0	0.02	
Valleyhead	102	47	78.3	2.14	
Verbena				0.00	
Wetumpka	101	56	83.2	0.14	
Alaska.					
Coal Harbor	71	37	52.6	0.33	
Fort Egbert	86	26	56.1	1.15	
Fort Liscum	79	36	55.1	0.24	
Juneau	80	42	67.3	2.41	
Ketchikan	78	46	57.5	3.31	
Killisnoo	71	36	55.0	1.60	
Sitka	77	36	53.9	1.87	
Skagway	86	37	59.3	0.30	
Arizona.					
Allaire Ranch				0.02	
Arizona Canal Co's Dam	115	56	85.4	0.13	
Aztec *[1]	125	80	99.0	0.00	
Benson *[1]	104	78	88.6	0.10	
Bisbee	99	52	77.8	0.30	
Buckeye	110	48	81.4	0.00	
Casagrande	114	78	94.1	0.00	
Champie Camp	118	48	84.0	0.20	
Cochise *[1]	109	65	88.7	0.00	
Congress	107	57	84.0	0.27	
Dragoon Summit *[1]	104	55	78.7	0.00	
Dudleyville	114	47	80.9	0.03	
Duncan	109	32	74.0	0.06	
Fort Apache	104	41	71.9	0.50	
Fort Defiance	93	28	65.6	0.70	
Fort Grant	105	56	80.9	T.	
Fort Huachuca	100	62	82.8	1.03	
Fort Mohave	123	53	88.5	0.00	
Gilabend *[1]	117	68	89.8	0.00	
Globe	109	40	77.5	T.	
Jerome	104	52	80.4	T.	
Kingman [e]	107	46	79.4	0.00	
Maricopa *[1]	118	63	92.1	T.	
Mesa	115	49	84.0	T.	
Mesa (near)	116	48	84.0	0.00	
Mohawk Summit *[1]	123	82	97.0	0.00	
Mount Huachuca	105	49	78.1	0.33	
Natural Bridge				T.	
Nogales	107	50	78.9	0.34	
Oracle	103	55	79.6	0.00	
Oro				0.44	
Arizona—Cont'd.					
Parker	121	48	86.6	T.	
Phoenix	119	48	84.0	0.23	
Pima	112	45	80.5	0.04	
Pinal Ranch				T.	
Prescott	98	29	67.8	0.00	
St. Johns	103	36	71.8	0.20	
San Carlos	115	48	81.7	T.	
Sentinel *[1]	119	76	96.4	0.00	
Showlow				0.17	
Signal	121	47	84.4	T.	
Superstition				0.13	
Taylor	101	30	70.4	0.14	
Tombstone	103	55	80.2	0.33	
Tonto	113	51	81.4	0.00	
Tuba	103	46	76.4	T.	
Tucson	112	50	83.1	0.19	
Vail *[5]	106	72	88.4	T.	
Walnut Grove				0.00	
Willcox *[1]	105	71	85.6	0.00	
Yarnell				0.61	
Arkansas.					
Alco	98	47	74.7	8.27	
Amity	98	51	76.8	5.58	
Arkadelphia				4.75	
Arkansas City				1.20	
Batesville	98	51	76.8	8.30	
Beebranch	99	50	76.8	4.35	
Blanchard Springs	97	51	79.2	4.53	
Brinkley	98	48	77.8	7.33	
Camden [a]				7.40	
Camden [b]	98	55	80.3	7.01	
Conway	100[c]	50[c]	79.0[c]	3.94	
Corning	95	51	74.8	6.51	
Dallas	95	50	76.9	6.05	
Dardanelle				3.77	
De Queen	100	54	80.8	4.53	
Dutton	92	45	72.2	6.13	
Elon	97	50	79.4	0.30	
Eureka Springs	95	46	74.0	9.28	
Fayetteville	99	43	78.0	6.52	
Forrest City	104	52	80.0	5.36	
Fulton				3.74	
Helena [a]				7.11	
Helena [b]	97	51	78.5	4.37	
Jonesboro	99	51	78.0	7.12	
Keesees Ferry	98	48	74.6	6.58	
Lacrosse [d]	96	50	74.4	6.07	
Lake Village	99	52	80.1	0.59	
Lonoke	97	47	77.1	3.64	
Lutherville	98	56	76.6	6.82	
Malvern	100	48	78.6	3.50	
Marianna	101	51	79.4	5.71	
Marvell	100	51	79.4	4.83	
Mossville	90	48	73.0	7.92	
Mountain Home	98	48	74.8	5.34	
Mount Nebo	93	53	75.6	3.62	
New Gascony	105	51	81.3	6.83	
Newport [a]				5.48	
Newport [b]	103	50	77.7	5.41	
Newport [c]	100	51	78.0	5.05	
Oregon	97	42	73.2	5.81	
Ozark [f]	103	54	80.4	4.73	
Perry	98	48	78.6		
Pinebluff	101	51	79.8	5.72	
Pocahontas	97	49	75.5	6.38	
Pond	95	50	74.4	8.01	
Prescott	96	56	78.4	6.31	
Princeton	98	49	78.2	3.54	
Rison	103	49	80.6	4.27	
Rosadale	99	57	80.9	4.22	
Russellville	101	52	78.5	5.73	
Silversprings	95	45	74.2	7.68	
Spielerville	99	50	79.5	5.95	
Stuttgart	99	49	78.2	4.92	
Texarkana	102	54	81.0	3.15	
Warren	102	50	78.8	6.28	
Washington	93	56	78.2	3.83	
Wiggs	97	42	76.4	6.38	
Winchester [d]	99	49	78.8	4.49	
Winslow	90	45	72.6	4.03	
Witts Springs	87[c]	46[c]	69.2[c]	8.76	
California.					
Angiola	107	40	74.4	0.00	
Azusa	103	44	71.3	0.12	
Bakersfield	105	43	76.2	0.00	
Ballast Point L. H				0.00	
Bear Valley				0.29	
Berkeley	80	45	61.6	0.00	
Bishop	99	33	70.2	0.00	
Boca *[1]	84	19	50.9	0.00	
Bodie	79	10	50.4	0.00	
Bowman	87	36	65.1	0.46	
Branscomb				0.11	
Campbell	90	38	62.2	0.00	
Campo				0.12	
Cape Mendocino L. H				0.30	
Cedarville	90	31	63.0	0.20	
Chico *[1]	102	58	80.0	0.66	
California—Cont'd.					
Chino	106	54	73.4	0.08	
Cisco *[1]	75	30	52.0	0.40	4.0
Claremont	102	39	65.7	0.10	
Cloverdale	101	41	71.9	0.00	
Corning *[1]	99	59	79.2	0.10	
Coronado	78	54	65.4	T.	
Crescent City	70	38	54.8	1.93	
Crescent City L. H				2.37	
Cuyamaca	88	31	59.8	0.17	
Delano *[1]	106	45	85.1	0.00	
Delta *[1]	97	49	73.8	0.32	
Drytown	100	42	72.3		
Dunnigan *[1]	100	52	77.8	0.70	
Durham *[5]	98	52	74.2	0.00	
East Brother L. H				0.00	
Edmanton *[1]	90	33	60.6	0.00	
Elcajon	99	41	66.4	0.00	
Elmdale	105	38	73.2	0.00	
Elsinore	113	42	70.9	0.21	
Escondido	102	38	69.2	0.04	
Fallbrook	103	40	68.8	0.05	
Folsom City *[1]	103	56	77.0	0.07	
Fordyce Dam				0.32	
Fort Bragg				0.00	
Fort Ross	78	45	56.8	0.00	
Foster				0.02	
Fowler				0.00	
Georgetown	94	37	69.0	0.56	
Geyserville	94	62	77.7	0.00	
Gilroy (near)	95	37	63.9	0.00	
Goshen *[1]	105	63	82.4	0.00	
Grass Valley				0.23	
Greenville	92	28	59.7	0.03	
Hanford	108	45	78.7	0.00	
Healdsburg	99	38	66.6	0.00	
Hollister	93	38	62.2	0.00	
Humboldt L. H				0.24	
Idylwild	93	34	63.8	0.10	
Imperial	123	57	89.9	T.	
Indio *[1]	117	70	88.8	0.00	
Iowa Hill *[1]	87	45	68.4	0.66	
Irvine	92	58	71.7	0.17	
Jackson	91	43	70.4	0.15	
Jolon				0.00	
Keene[1] *	96	47	68.4	0.00	
Kennedy Gold Mine	94	37	67.6	0.00	
Kent	88	41	63.2	0.00	
Kernville				0.00	
King City *[1]	96	47	61.5	0.00	
Kono Tayee	89	46	69.6	0.00	
Laguna Valley				0.21	
Laporte *[1]	81	35	57.0	0.64	5.0
Legrande	106	50	78.4	0.00	
Lemoncove	104	43	77.3	0.00	
Lick Observatory	81	29	58.4	0.00	
Lime Point L. H				0.00	
Livermore	103	41	68.4	0.00	
Lodi	100	45	71.2	0.00	
Los Gatos	93	42	65.4	0.00	
Mammoth *[1]	117	76	89.1	0.00	
Manzana	107	48	79.6	T.	
Mare Island L. H				0.00	
Merced	107	42	74.9	0.00	
Mercury	100	46	73.0	0.00	
Milo				0.00	
Milton (near)	100	45	73.2	0.00	
Modesto *[1]	105	57	78.4	0.00	
Mohave *[1]	105	50	77.1	0.00	
Mokelumne Hill *[3]		46	67.0	0.00	
Monterio	96	38	69.4	0.00	
Monterey *[1]	78	49	59.4	0.24	
Mount St. Helena				0.00	
Napa	93	41	66.4	0.00	
Needles	115	64	91.2	T.	
Nevada City	90	34	63.2	0.24	
Newhall	110	55	71.2	0.00	
Newman	108	43	74.6	0.00	
Niles	90	42	63.3	0.00	
North Bloomfield	93	34	66.1	0.19	
North Ontario	102	42	68.0	0.05	
North San Juan *[1]	90	45	62.4	0.18	
Oakland	83	49	63.8	0.00	
Ogilby *[1]	122	71	93.4	0.05	
Orland *[1]	105	50	82.0	0.00	
Palermo	103	43	73.6	0.00	
Paso Robles	105	36	66.9	0.00	
Peachland *[5]	90	50	66.4	0.00	
Piedras Blancas L. H				0.00	
Pigeon Point L. H				0.00	
Pilot Creek				0.08	
Pine Crest	100	43	64.8	0.00	
Placerville	96	38	66.2	0.60	
Point Ano Nuevo L. H				0.00	
Point Arena L. H				0.00	
Point Bonita L. H				0.00	
Point Conception L. H				0.00	
Point Fermin L. H				0.00	
Point George L. H				0.41	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Point Hueneme L. H.				0.00	
Point Lobos	66	47	55.1	0.00	
Point Loma L. H.				0.00	
Point Montara L. H.				0.00	
Point Pinos L. H.				0.00	
Point Sur L. H.				0.00	
Pomona (near)	112	42	72.5	0.23	
Porterville	106[e]	47[e]	77.2[e]	0.00	
Poway				0.01	
Quincy	91	33	61.5	T.	
Redding	96	47	76.0	0.00	
Redlands	110	43	72.4	0.31	
Reedley	107	51	80.5	0.00	
Represa	96	46	72.4	0.06	
Riovista	99	47	77.0	0.08	
Riverside	105	40	69.4	0.05	
Roe Island L. H.				0.00	
Rohnerville *[5]	75	48	57.7	0.50	
Rosewood	107	41	76.2	T.	
Sacramento	94	47	71.2	0.01	
Salinas	84	39	60.3	0.00	
Salton *[1]	127	70	97.0	0.00	
San Bernardino	112	39	71.0	0.15	
San Jacinto	112	45	73.1	0.01	
San Jose	91	38	63.2	0.00	
San Leandro	85	42	62.7	0.00	
San Luis L. H.				0.00	
San Mateo *[1]	87	56	67.5	0.06	
San Miguel *[1]	100	48	71.0	0.00	
San Miguel Island	65	46	53.3	0.00	
Santa Barbara	84	48	62.8	0.00	
Santa Barbara L. H				0.00	
Santa Clara				0.30	
Santa Cruz	92	38	59.9	0.00	
Santa Cruz L. H.				0.00	
Santa Maria	83	42	61.4	T.	
Santa Monica	76	44	59.5	0.00	
Santa Paula	105	44	68.9	0.00	
Santa Rosa *[1]	96	39	64.8	0.00	
Shasta	101	45	77.4	0.00	
Sierra Madre	102	45	67.9	0.05	
Sonoma				0.00	
S. E. Farallone L. H.				0.00	
Stockton	97	46	70.4	0.00	
Storey	105	42	75.0	0.00	
Summerdale	84	29	62.0	0.11	1.0
Susanville	92	34	65.0	0.00	
Tehama *[1]	99	61	83.4	0.00	
Tejon Ranch	98	50	77.8	0.00	
Templeton *[5]	106	44	64.8	0.00	
Trinidad L. H				0.40	
Truckee *[1]	78	30	47.8	0.00	
Tulare *b*				0.00	
Tulare *c*	104	46	75.9	0.00	
Ukiah	101	37	65.0	0.00	
Upperlake	98	39	67.8	0.00	
Upper Mattole *[1]	84	40	56.7	0.27	
Vacaville *[1]	104	52	72.7	0.00	
Ventura	79	48	63.8	0.00	
Visalia		46		0.00	
Volcano Springs *[1]	129	76	98.5	0.00	
Wasco	107	44	77.6	0.00	
Westpoint				0.00	
West Saticoy				0.00	
Wheatland	98	45	71.2	0.00	
Williams *[1]	100	56	81.0	0.98	
Willits	100	38	64.8	0.00	
Willows	98	46	74.6	0.00	
Wilmington *[1]	82	45	63.0	T.	
Wire Bridge *[5]	98	51	74.6	0.55	
Yerba Buena L. H.				0.00	
Yreka	91	37	63.4	0.03	
Yuba City *[5]	96	52	77.0	0.00	
Zenia				0.16	
Colorado.					
Alford	92	34	61.0	2.02	
Arkins				1.56	
Ashcroft	83	22	54.8	0.82	
Blaine	110	47	71.8	1.49	
Boulder	94	41	66.8	1.46	
Boxelder				1.80	
Breckenridge	79	14	50.2	0.92	5.5
Buenavista				0.00	
Canyon	97	41	69.9	1.37	
Castlerock	95	38	65.4	1.50	
Cedaredge	98	35	67.0	0.19	
Cheyenne Wells	103	43	67.4	2.53	
Clearview	83	26	56.4	0.27	
Collbran	95	31	66.9	0.97	
Colorado Springs	94	40	64.7	1.56	
Delta	102	34	69.4	0.26	
Durango	95	33	66.6	0.16	
Fort Collins	96	37	63.6	2.43	
Fort Morgan	98	41	66.3	1.46	
Fox	100	41	67.4	2.05	
Garnett	89	32	61.1	0.85	
Gilman				0.54	
Gleneyre	97	36	63.0	0.73	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Glenwood	94	28	62.4	0.50	
Greeley	101	41	67.8	0.62	
Grover				1.05	
Gunnison	87	28	58.2	0.36	
Hamps	92	39	62.9	2.52	
Hoehne	99	41	70.1	0.35	
Holyoke (near)	103	37	65.4	4.02	
Husted	95	35	61.8	1.81	
Lake Moraine	81	29	52.5	1.62	
Lamar	105	45	73.4	1.05	
Laporte				2.62	
Las Animas	101	44	70.9	1.77	
Lay	94	23	60.6	0.34	
Leadville (near)				0.55	4.0
Leroy	101	36	65.6	1.82	
Longs Peak	77	26	52.1	1.40	
Mancos	90[e]	28	61.4	0.05	
Marshall Pass				0.44	2.0
Meeker	93	24	62.0	0.60	
Mitchell	80	35		0.45	2.0
Montrose				0.25	
Moraine	84	30	56.6	0.55	
Pagoda	89	25	59.0	0.41	
Parachute	100	32	68.2	0.44	
Rockyford	103	48	71.2	0.60	
Rogers Mesa	99	36	69.0	0.27	
Ruby				0.10	1.0
Russell	91	22	55.6	0.10	
Saguache	88	36	62.0	0.31	
Salida	91	32	63.0	0.21	
San Luis	87	30	60.8	0.08	
Santa Clara	90	36	62.3	7.64	
Sapinero				0.05	
Seibert				2.00	
Silt	95	35	68.6	0.45	
Sugarloaf	90	34	60.6	2.08	
Telluride	87	27	59.4	0.18	
Trinidad	95	42	68.3	0.52	
Twinlakes				0.48	
Vilas				1.21	
Wagon Wheel	87	20	54.0	0.40	
Walden	84	23	55.8	0.30	
Wallet				4.35	
Westcliffe	89	31	60.0	0.52	
Whitepine	74	24	51.4	1.03	
Wray	101	41	69.0	5.69	
Yuma				1.91	
Connecticut.					
Bridgeport	92	44	65.3	5.70	
Canton	86	36	60.4	4.20	
Colchester	88	43	64.2	3.65	
Falls Village				4.83	
Hartford	90	47	64.8	4.66	
Hawleyville	87	42	63.6	4.19	
Lake Konomoc				3.99	
Middletown	93	44	66.0	4.33	
New London	87	43	62.4	2.77	
North Grosvenor Dale	90	40	63.6	3.91	
Norwalk	94	40	65.7	4.72	
Southington	88	42	64.0	3.70	
South Manchester				4.39	
Storrs	89	39	61.8	3.24	
Voluntown	90	39	63.0	3.97	
Wallingford				4.44	
Waterbury	92	43	66.2	5.16	
West Cornwall	87	42	62.8	5.06	
West Simsbury				3.52	
Winsted	88	48.	63.6		
Delaware.					
Milford	101	47	72.6	6.67	
Millsboro	96	47	70.8	5.61	
Newark	92	45	69.0	5.85	
Seaford	96	50	72.8	6.86	
District of Columbia.					
Distributing Reservoir *[5]	90	59	74.0	2.55	
Receiving Reservoir *[5]	89	57	73.0	2.89	
West Washington	96	44	71.8	4.11	
Florida.					
Archer	99	60	80.6	6.22	
Avon Park	98	64	80.8	5.70	
Bartow	94	69	81.6	6.62	
Bonifay	97	63	81.3	3.60	
Brooksville	96	64	80.4	4.06	
Carrabelle	94	68	81.0	7.06	
Clermont	101	67	82.6	2.50	
De Funiak Springs	98	63	81.2	2.71	
Eustis	103	66	82.4	5.31	
Fernandina	96	66	79.8	3.69	
Flamingo	90	70	81.8	4.15	
Fort Meade	98	63	80.8	9.90	
Fort Myers	94	67	79.8	8.63	
Fort Pierce	93	62	80.2	5.92	
Gainesville	99	63	81.2	8.21	
Huntington	98	59	79.6	2.66	
Hypoluxo	93	70	80.0	7.88	
Inverness	97	63	81.0	1.93	
Johnstown	97	58	79.5	6.43	
Kissimmee	100	63	81.6	5.85	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Lake City	98	62	80.0	9.42	
Macclenny	101	58	80.7	5.23	
Malabar	95	66	81.3	8.63	
Manatee	95	64	80.6	6.28	
Marco	95	67	81.0	8.61	
Marianna	96	64	81.0	3.63	
Merritt Island	92	71	81.2	11.14	
Miami	94	72	82.3	6.01	
Micanopy	99	60	80.2	5.75	
Molino	102	55	82.1	0.00	
New Smyrna	96	60	80.0	5.10	
Nocatee	99	65	81.6	9.12	
Ocala	100	60	81.0	5.93	
Orange City [a]	96	58	79.6	3.92	
Orlando	96	67	81.4	6.94	
Pinemount	99	62	80.2	15.01	
Quincy	99	53	80.8	8.06	
Rideout	101	57	79.5	8.97	
St. Andrews	93	64	80.8	1.96	
St. Augustine	95	67	80.0	2.95	
St. Leo	99	64	81.8	5.83	
Stephensville	96			5.86	
Sumner	95	55	78.6	1.77	
Switzerland	98	57	79.5	6.30	
Tallahassee	95	66	80.7	9.94	
Tarpon Springs	94	64	80.4	2.82	
Titusville	96	64	80.0	4.14	
Waukeenah	98	65	82.2	10.97	
Wausau [a]	99	61	81.3	4.46	
Wewahitchka	95	64	80.4	4.87	
Georgia.					
Adairsville		56			
Albany	107	66	84.3	6.33	
Allapaha	95	61	79.5	8.09	
Allentown	99	62	80.5	3.19	
Alpharetta	98	52	76.6	3.96	
Americus	99	66	84.5	3.48	
Athens	97	63	77.4	3.38	
Bainbridge	97	65	81.5	7.16	
Blakely	96			5.23	
Bowersville	100	57	78.2	2.39	
Brent	101	60	80.2	3.04	
Butler				2.33	
Camak	101	60	79.2	4.67	
Canton				1.91	
Carlton				3.41	
Clayton	95	50	72.8	2.16	
Columbus	99	64	83.2	2.91	
Covington	101	54	79.8	1.79	
Dahlonega	96	55	75.8	1.31	
Diamond	95	52	73.4	1.80	
Douglas	102	60	81.8	6.30	
Dublin				2.25	
Eastman	100	64	82.0	2.53	
Elberton	102	60	79.2	2.08	
Experiment	98	54	79.1	1.90	
Fitzgerald	101	60	81.2	3.78	
Fleming	102	58	78.7	6.79	
Fort Gaines	100	63	83.0	2.86	
Gainesville	98	59	76.8	2.01	
Gillsville	99	57	78.2	1.65	
Greensboro	98	60	77.7	3.16	
Griffin	102	58	81.2	1.50	
Harrison	101	61	79.5	2.91	
Hawkinsville	100	59	80.0	2.51	
Hephzibah	100	62	81.0	2.68	
Lost Mountain	99	57	78.6	2.02	
Louisville	100	63	79.9	3.13	
Lumpkin	101	60	81.0	5.32	
Marshallville	99	66	82.2	3.04	
Mauzy	102	60	81.2	7.23	
Milledgeville	99	61	80.4	4.62	
Millen	101	61	81.2	4.60	
Monticello	100	58	80.0	4.21	
Morgan	97	61	79.6	5.92	
Naylor				8.10	
Newnan	101	57	80.0	2.00	
Point Peter	102	57	78.4	2.03	
Poulan	99	59	79.2	4.57	
Putnam	100	61	80.6	2.15	
Quitman	99	61	81.4	9.50	
Ramsey	96	49	76.6	4.32	
Resaca				1.28	
Rome	103	52	79.8	1.20	
St. Marys	103	62	80.2	3.28	
Statesboro	102[e]	60[e]	80.2[e]	7.44	
Stillmore	99	63	80.0	5.00	
Talbotton	101	57	80.4	0.90	
Tallapoosa	103	50	79.0	0.70	
Thomasville	98	60	81.0	7.97	
Toccoa	100	57	76.9	2.21	
Valona	99	61	79.4	5.50	
Vidalia	99	62	80.6	5.58	
Washington	100	61	79.4	3.30	
Waverly	100	60	79.5	3.29	
Waycross	98	64	82.0	9.59	
Waynesboro	98	63	78.5	4.05	
Westpoint	100	56	81.6	1.54	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Georgia—Cont'd.					
Woodbury	99	51	78.6	2.93	
Idaho.					
Albion	95	.....	.....	0.29	
American Falls	98	33	63.0	0.12	
Blackfoot	99	35	65.1	T.	
Chesterfield	90	23	56.1	1.22	
Downey	94	30	59.4	0.08	
Forney	90	21	51.9	1.54	
Garnet	106	37	71.4	0.44	
Hailey	95	25	61.0	0.18	
Idaho City	86	32	57.8	.....	
Lake	80	28	55.3	0.83	
Lakeview	85	34	56.8	1.24	
Lost River	95	29	60.0	0.19	
Moscow	95	35	58.2	0.59	
Murray	83	31	54.7	1.69	
Oakley	98	32	62.9	0.50	
Ola	97	35	62.0	0.60	
Payette	102	38	66.2	0.71	
Pollock	98	37	60.5	1.03	
Porthill	87	32	56.6	1.45	
Priest River	84	30	54.2	1.38	
Riddle	93	24	58.4	0.12	
St. Maries	87	35	58.7	1.12	
Silver City	88	29	57.4	1.08	
Soldier	91	25	56.6	0.11	
Vernon	93	25	58.0	0.53	
Weston [c]	97	29	62.2	0.54	
Illinois.					
Albion	98	48	73.8	4.98	
Aledo	88	42	65.8	7.81	
Alexander	95	44	69.8	70.1	
Antioch	86	41	64.2	5.90	
Ashton	87	40	64.0	10.41	
Astoria	93	41	68.0	8.71	
Aurora	91	42	66.0	13.19	
Beardstown	.....	.....	.....	8.01	
Benton	100	45	76.0	2.88	
Bloomington	95	42	69.4	12.45	
Bushnell	95	43	68.6	6.90	
Cambridge	90	44	68.6	7.89	
Carlinville	98	44	71.4	10.82	
Carrollton	96	45	71.2	8.93	
Centralia	100	42	73.5	5.03	
Charleston	95	45	71.6	7.78	
Chemung	85	40	62.0	5.20	
Chester	.....	.....	.....	3.27	
Cisne	98	46	72.4	4.55	
Coatsburg	94	45	70.2	9.90	
Cobden	100	47	75.7	2.78	
Decatur	95	41	69.7	9.03	
Dixon	91	44	66.0	9.75	
Dwight	93	43	67.6	11.53	
Effingham	101	44	75.1	6.71	
Equality	98	46	73.6	1.84	
Flora	96	46	71.9	4.63	
Friendgrove *[b]	.....	.....	75.6	4.48	
Galva	90	41	65.6	8.96	
Grafton	.....	.....	.....	8.48	
Greenville	99	45	72.7	8.15	
Griggsville	94	45	70.4	7.33	
Halfway	98	46	74.6	2.87	
Halliday	99	46	74.4	3.85	
Henry	90	43	67.4	11.21	
Hillsboro	98	45	71.2	8.93	
Hoopestown	96	45	68.8	14.37	
Joliet	91	45	66.1	12.86	
Kishwaukee	87	42	64.6	7.45	
Knoxville	90	43	65.6	9.63	
Lagrange	93	44	65.7	10.64	
Laharpe	93	41	67.2	9.70	
Lanark	90	38	64.6	10.51	
Lasalle	90	43	69.4	8.90	
Loami	.....	.....	.....	7.79	
McLeansboro	99	48	75.0	2.68	
Martinsville	97	44	71.8	6.48	
Martinton	91	42	67.2	12.53	
Mascoutah	98	47	71.9	5.00	
Mattoon	90	44	68.0	14.83	
Minonk	90	40	66.1	9.41	
Monmouth	92	40	64.9	13.97	
Morgan Park	.....	.....	.....	10.70	
Morrison	88	42	65.6	9.60	
Morrisonville	95	43	69.8	10.61	
Mount Carmel	.....	.....	.....	4.98	
Mount Pulaski	94	44	70.2	8.46	
Mount Vernon	96	46	72.3	5.35	
New Burnside	99	45	75.4	3.40	
Olney	98	47	73.6	4.70	
Ottawa	93	47	68.8	10.51	
Palestine	100	47	74.0	7.73	
Pana	94	43	71.5	10.43	
Paris	95	45	71.4	9.04	
Peoria *a*	.....	.....	.....	10.76	
Peoria *b*	95	48	70.6	9.60	
Philo	95	40	69.4	7.38	
Plumhill	96	47	72.6	5.04	
Rantoul	95	43	69.8	13.54	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Illinois—Cont'd.					
Raum	98	48	74.9	2.16	
Riley	87	42	63.6	6.83	
Robinson	95	44	71.2	6.34	
Rockford	90	43	65.7	7.74	
Rushville	92	42	69.4	8.34	
St. Charles *[b]	88	52	68.5	7.36	
St. John	100	48	75.4	3.03	
Scales Mound	88	40	64.6	7.63	
Shobonier	97	42	72.0	6.62	
Strawn	91	44	67.0	14.00	
Streator	91	43	66.8	10.64	
Sullivan	95	44	70.0	8.82	
Sycamore	91	42	65.8	9.00	
Tilden	98	45	73.6	2.82	
Tiskilwa	88	43	65.4	8.19	
Tuscola	96	43	70.0	8.56	
Walnut	93	44	67.2	8.89	
Wellington	91	45	68.3	10.49	
Winchester	95	46	70.8	7.49	
Winnebago	88	40	64.2	8.76	
Yorkville	89	44	65.6	14.44	
Zion	89	43	65.5	7.80	
Indiana.					
Anderson	92	43	68.7	10.04	
Angola	89	43	64.1	8.52	
Auburn	90	40	64.8	7.84	
Bloomington	94	49	71.5	5.02	
Bluffton	97	40	67.5	9.03	
Butlerville	93	43	70.1	5.75	
Cambridge City	93	39	67.8	9.75	
Columbus	95	43	70.0	4.30	
Connersville	93	42	69.0	8.96	
Crawfordsville	98	46	71.4	6.31	
Delphi	94	43	68.0	13.14	
Edwardsville	92	53	73.0	7.35	
Fairmount	96	42	69.0	8.96	
Farmland	91	45	67.5	8.30	
Fort Wayne	95	39	66.2	7.32	
Franklin	93	58	71.4	10.00	
Greencastle	92	48	70.0	6.88	
Greensburg	92	46	71.2	12.55	
Hammond	90	46	64.8	7.29	
Hector	95	43	68.2	7.04	
Huntington	92	45	67.0	9.03	
Jeffersonville	96	50	73.6	5.04	
Knightstown	95	43	70.2	7.44	
Kokomo	94	48	68.4	9.13	
Lafayette	92	44	68.4	11.37	
Laporte	94	41	67.0	8.68	
Logansport	96	45	68.6	9.55	
Madison *a*	98	48	73.4	3.30	
Madison *b*	.....	.....	.....	3.89	
Marengo	95	46	71.8	6.41	
Marion	97	41	68.4	8.02	
Markle	90	41	65.8	8.20	
Mauzy	94	41	69.0	8.03	
Moores Hill	93	45	70.4	5.52	
Mount Vernon	100	48	76.0	4.27	
Northfield	94	39	67.5	6.38	
Paoli	96	45	71.4	6.90	
Prairie Creek	98	43	72.4	3.76	
Princeton	98	44	73.3	4.90	
Rensselaer	93[c]	46[d]	69.1[e]	13.90	
Richmond	92	40	68.2	9.41	
Rockville	92	45	69.0	7.29	
Salem	98	43	72.6	5.76	
Scottsburg	97	48	73.0	4.75	
Seymour	94	42	70.4	5.30	
Shelbyville	95	48	73.0	6.97	
South Bend	89	45	65.3	7.39	
Syracuse	94	43	66.0	8.76	
Terre Haute	98	50	72.2	6.41	
Topeka	88	44	64.0	6.30	
Valparaiso	90	44	65.5	.....	
Veedersburg	96[d]	42[d]	69.8[d]	8.41	
Vevay	92	49	72.0	4.05	
Vincennes	101	48	73.8	6.00	
Washington	101	46	73.6	5.25	
Winamac	91	31	65.2	10.94	
Worthington	96	45	71.4	6.82	
Indian Territory.					
Ardmore	109	53	81.9	0.54	
Bengal	97	47	72.6	6.70	
Chickasha	103	47	78.6	0.51	
Durant	103	54	81.0	2.30	
Fairland	94	45	74.2	6.14	
Hartshorne	98	49	79.4	3.97	
Healdton	110	49	80.9	0.65	
Holdenville	100	47	77.4	1.52	
Marlow	106	51	78.7	0.40	
Muskogee	99	48	77.5	3.95	
Ryan	110	52	83.0	0.57	
South McAlester	.....	.....	.....	4.19	
Tahlequah	99	44	77.5	6.98	
Tulsa	.....	.....	.....	0.75	
Webbers Falls	.....	.....	.....	3.87	
Iowa.					
Afton	93	43	67.2	4.88	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Iowa—Cont'd.					
Albia	94	44	66.0	7.93	
Algona	90	41	65.0	4.10	
Allerton	93	42	66.8	7.15	
Alta	88	38	62.9	6.59	
Amana	88	41	65.8	6.86	
Ames	89	42	65.6	10.01	
Atlantic	93	38	65.8	6.89	
Audubon	92	38	65.2	5.86	
Baxter	89	42	64.8	10.76	
Bedford	93	40	66.2	10.62	
Belknap	90	42	65.6	8.90	
Bonaparte	93	42	66.8	9.94	
Britt	90	36	64.0	3.87	
Buckingham	.....	.....	.....	13.56	
Burlington	91	42	67.8	11.65	
Bussey	.....	.....	.....	5.89	
Carroll	92	38	64.8	9.34	
Cedar Rapids	89	44	66.4	5.57	
Centerville	94	42	66.2	6.97	
Chariton	90	40	65.6	7.19	
Charles City	96	39	67.8	8.36	
Chester	83	37	62.8	5.74	
Clarinda	96	41	66.9	11.64	
Clearlake	90	42	64.4	5.30	
Clinton	94	40	66.3	9.90	
College Springs	.....	.....	.....	9.61	
Columbus Junction	92	30	61.4	7.77	
Corning	92	41	65.4	5.70	
Council Bluffs	96	42	67.1	9.84	
Cresco	82	38	60.2	4.12	
Cumberland	.....	.....	.....	6.06	
Danville	.....	.....	.....	12.74	
Decorah	82	41	63.9	5.35	
Delaware	87	39	63.5	6.62	
Denison	89	40	64.2	4.62	
De Soto	93	42	69.2	6.02	
Dows	87	38	64.4	5.82	
Earlham	91	36	64.4	5.55	
Eldon	94	41	66.7	6.72	
Elkader	91	39	65.4	12.46	
Emerson	.....	.....	.....	6.90	
Estherville	89	35	62.6	5.61	
Fairfield	90	39	66.0	9.34	
Fayette	87	37	63.3	8.81	
Forest City	85	40	63.4	5.85	
Fort Dodge	90	34	64.0	.....	
Fort Madison	.....	.....	.....	9.05	
Galva *c*	89	36	65.3	7.01	
Gilman	.....	.....	.....	7.00	
Grand Meadow	85	40	63.0	6.55	
Greene	90	38	65.3	4.67	
Greenfield	90	39	65.1	6.27	
Grinnell (near)	86	42	65.1	9.39	
Grundy Center	86	39	64.0	16.04	
Guthrie Center	92	35	64.6	6.99	
Hampton	88	41	64.4	8.30	
Harlan	91	40	65.8	7.87	
Hopeville	.....	.....	.....	5.67	
Humboldt	90	39	65.3	8.00	
Independence	84[d]	41[b]	63.4[c]	9.03	
Indianola	90	43	66.2	.....	
Imwood	.....	.....	.....	2.85	
Iowa City	91	42	66.6	7.46	
Iowa Falls	88	38	64.0	10.01	
Jefferson	.....	.....	.....	9.21	
Keosauqua	97	42	68.2	9.13	
Lacona	.....	.....	.....	6.25	
Lansing	86	40	65.6	3.52	
Larrabee	90	34	64.4	4.79	
Leclaire	.....	.....	.....	10.62	
Lemars	91	38	64.8	4.68	
Lenox	89	40	65.3	5.99	
Leon	93	43	67.7	7.72	
Logan	93	40	66.1	7.52	
Maple Valley	.....	.....	.....	6.73	
Maquoketa	90	39	65.0	8.67	
Marshalltown	92	41	65.9	12.31	
Monticello	90	39	65.9	9.78	
Mountayr	93	41	65.9	8.18	
Mount Pleasant	92	36	65.4	10.96	
Mount Vernon	89	41	65.5	8.10	
New Hampton	82	39	63.1	7.38	
Newton	86	43	64.3	8.87	
Northwood	84	41	63.0	6.96	
Odebolt	94	38	66.6	6.23	
Ogden	90	40	66.1	7.86	
Olin	88	39	64.8	6.63	
Onawa	94	42	68.8	5.50	
Osage	81	41	62.6	7.60	
Osceola	87	42	64.2	5.42	
Oskaloosa	91	40	65.6	7.24	
Ottumwa	90	45	67.6	8.42	
Ovid	89	40	65.6	6.04	
Pacific Junction	95	40	67.7	6.64	
Perry	91	41	66.6	8.72	
Plover	92	33	62.6	7.24	
Redoak	89	44	67.0	8.90	
Ridgeway	88	43	64.7	5.94	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rockford				5.17	
Rockwell City	90	38	64.0	6.12	
Ruthven	91	37	64.6	3.30	
Sac City	91	40	65.9	5.63	
St. Charles	90	43	66.2	6.71	
Scranton	90	41	66.0	6.77	
Sheldon	92	35	63.8	1.46	
Sibley	94	32	63.6	1.89	
Sigourney	96	40	66.6	8.61	
Sioux Center	91	37	65.0	1.63	
Spirit Lake	89	38	64.8	2.98	
Stockport				9.11	
Storm Lake	87	38	63.2	5.37	
Stuart	92	42	66.7	6.13	
Thurman	96	40	67.8	9.66	
Tipton	87	40	63.8	8.35	
Villisca	93	40	65.9	7.37	
Vinton *[1]	88	50	64.9	8.26	
Wapello	87	42	65.6	7.87	
Washington	90	38	64.0	7.68	
Washta				3.54	
Waterloo	88	40	64.6	6.81	
Waverly	85	40	64.2	5.77	
Westbend	90	39	64.8	4.39	
Westbranch				6.88	
West Union				6.36	
Whitten	88	39	64.4	11.52	
Wilton Junction	93	39	67.2	8.33	
Winterset	89	42	66.0	6.90	
Woodburn				6.60	
Kansas.					
Abilene	99	34	67.0	10.94	
Achilles	102	34	66.6	2.70	
Anthony				2.97	
Atchison	95	46	69.4	5.05	
Baker	94	43	68.4	7.44	
Beloit	103	45	69.8	7.52	
Burlington	94	44	71.8	9.07	
Clay Center	98			11.66	
Colby	105	35	69.0	1.92	
Columbus	93	47	72.4	12.45	
Coolidge	101	44	70.5	1.88	
Delphos	99	42	70.0	10.40	
Dresden	102	39	67.7	4.67	
Ellinwood	100	44	70.3	6.00	
Emporia	96	52	71.6	9.17	
Englewood	97	46	73.3	5.45	
Eureka Ranch	105	38	70.0	6.53	
Fallriver	93	46	72.2	10.20	
Farnsworth	103	43	69.6	5.33	
Forsha	97	48	71.6	2.50	
Fort Leavenworth	97	48	70.4	3.49	
Fort Scott	96	46	72.8	4.95	
Frankfort	99	43	70.0	6.37	
Fredonia	90	48	72.0	11.33	
Garden City	99	46	72.6	2.43	
Gove *[1]	106	40	66.6	2.85	
Grenola	95	44	72.0	8.21	
Hanover	100	42	69.8	6.79	
Harrison	104	42	68.7	6.23	
Hays	105	40	69.8	6.44	
Horton	96	45	68.4	7.02	
Hoxie	106	37	70.0	3.28	
Hutchinson	99	44	71.4	4.90	
Independence	100	50	75.2	8.58	
Jetmore	101	42	71.2	3.45	
Lakin	99	43	71.8	0.48	
Lebanon	103	40	69.0	5.20	
Lebo	91	46	71.0	10.01	
Leoti	100	42	69.6	3.18	
Little River	99	44	70.8	7.14	
Macksville	99	45	70.8	6.72	
McPherson	97	43	71.2	7.30	
Madison		43		10.22	
Manhattan	98	44	71.8	7.96	
Marion	95	46	72.9	6.20	
Meade	98	47	73.1	5.67	
Medicine Lodge	98	47	74.9	3.90	
Minneapolis	98	43	69.8	10.31	
Moran	91	45	71.7	5.50	
Mounthope *[1]	96	56	73.3	4.98	
Ness City	105	48	73.6	4.62	
Norwich	97	48	73.2	3.52	
Oberlin				3.43	
Olathe	92	45	69.2	4.41	
Osage City	93	43	70.4	7.95	
Oswego	92	47	72.6	9.54	
Ottawa	95	41	70.6	5.86	
Paola		46		6.09	
Phillipsburg				5.66	
Rome	98	44	74.1	5.29	
Salina	100	42	71.0	7.33	
Sedan	95	46	73.8	9.46	
Seneca	97	41	69.1	5.35	
Toronto	93	44	71.7	7.90	
Ulysses	98[b]	52[e]	72.0	2.83	
Valley Falls	93	45	68.9	4.44	
Viroqua	106	48	71.5	2.18	
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wakeeney				4.55	
Wallace *[1]	104	47	72.4	3.19	
Wamego *[1]	96	50	69.9	7.11	
Winfield	96	46	74.7	5.01	
Yates Center	92	48	72.6	7.61	
Kentucky.					
Alpha	95	46	73.0	6.64	
Anchorage	95	44	71.3	4.65	
Bardstown	97	45	73.6	5.71	
Berea	94	42	71.4	6.81	
Blandville	96	50	75.5	4.80	
Bowling Green	101	45	74.8	3.22	
Burnside	100			3.67	
Catlettsburg				5.36	
Centertown	99	44	74.2	3.35	
Earlington	97	43	74.6	3.95	
Edmonton	97	43	73.2	2.77	
Eubank	94	44	71.0	4.05	
Falmouth				4.89	
Fords Ferry	97	42	74.2	4.18	
Frankfort	93	48	72.0	5.50	
Franklin	95	42	74.0	1.40	
Greensburg	97	45	74.6	3.46	
Henderson	100	50	76.3	3.23	
High Bridge	94	48	73.1	7.77	
Hopkinsville	100	47	75.4	5.18	
Irvington	98	45	73.8	5.23	
Leitchfield	96	47	72.8	5.51	
Loretto	96	42	72.4	7.26	
Manchester	95	39	71.4	7.54	
Marrowbone	97	43	72.4	4.05	
Mayfield	98	51	76.7	2.36	
Maysville	99	46	72.1	5.48	
Mount Sterling	97	46	71.6	4.79	
Owensboro	98	53	74.8	2.31	
Owenton	90	50	70.2	6.35	
Paducah *a*				2.69	
Paducah *b*	100	53	77.8	2.74	
Pikeville	97	49	72.8	7.32	
Richmond	92	47	71.1	6.28	
St. John	95	46	72.8	5.16	
Scott	95	46	71.0	4.33	
Shelby City	94	43	71.5	4.66	
Shelbyville	98	46	72.9	3.82	
Williamsburg	96	47	73.1	5.05	
Williamstown	95	49	72.8	5.64	
Louisiana.					
Abbeville	95	62	81.2	1.88	
Alexandria	103	54	82.6	0.53	
Amite	102	50	80.0	2.46	
Baton Rouge	99	60	81.6	1.71	
Burnside	98	60	80.8	1.18	
Calhoun	101	55	79.6	0.99	
Cameron	96	62	82.4	1.14	
Cheneyville	101	52	82.3	0.20	
Clinton	98	58	81.6	0.77	
Collinston	102	56	82.4	2.29	
Covington	102	61	83.2	1.10	
Donaldsonville	98	63	81.4	1.10	
Emilie	99	64	81.2	2.19	
Farmerville	98	59	80.3	0.86	
Franklin	99	64	82.0	1.52	
Grand Coteau	103	61	81.9	1.16	
Hammond	101	59	82.4	1.41	
Houma	99	63[e]	81.9[e]	1.53	
Jennings	98	59	80.9	1.22	
Lafayette	103	60	81.7	2.12	
Lake Charles	97	62	81.4	0.28	
Lake Providence	96	58	80.2	3.82	
Lakeside	98	64	81.4	1.51	
Lawrence	98	66	82.5	0.33	
Libertyhill	103	55	82.6	0.99	
Mansfield	99	51	79.2	3.60	
Melville	99	55	80.0	0.85	
Minden	102	65	82.7	2.53	
Monroe	98	57	81.4	0.27	
New Iberia	94	62	81.4	1.75	
Opelousas	101	57	81.4	0.37	
Oxford	102	50	80.2	3.84	
Paincourtville	98	61	81.4	3.58	
Plain Dealing	98[b]	53[b]	79.5[b]	12.52	
Prevost				0.00	
Rayne	102	63	83.0	1.37	
Reserve	103	65	82.8	2.13	
Robeline	100	50	81.8	1.00	
Ruddock	96	60	80.0	1.60	
Ruston	102[e]	49[e]	81.4[e]	0.70	
Schriever	98	61	80.8	2.28	
Southern University				1.13	
Sugar Experiment Station	96	66	82.8	1.30	
Sugartown	98	59	82.8	0.00	
Venice		63		0.00	
Wallace	102	66	81.8	4.18	
Maine.					
Bar Harbor	84	38	58.1	4.60	
Belfast	85	37	56.8	6.38	
Bemis	78	34	57.4	4.63	
Calais	85	36	62.7	4.60	
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Carmel	82	31	57.8	5.57	
Cornish	86	40	60.7	4.92	
Fairfield	85	36	60.6	4.04	
Farmington	86	34	59.4	5.28	
Fort Fairfield	88[e]	20[e]	55.2[e]	4.38	
Gardiner	88	40	61.2	4.52	
Houlton	85	33	56.8	8.06	
Kineo	81	33	54.4	6.15	
Lewiston	88	40	61.4	5.21	
Mayfield	83	34	57.0	7.39	
North Bridgton	87	39	60.7	5.50	
Orono	84	34	56.8	6.03	
Patten	82	30	55.2	6.20	
Roach River	80	38	58.0	9.29	
Rumford Falls	83	34	58.8	4.45	
Vanburen	86	31	57.0	6.54	
Vanceboro	83	44	62.2	4.15	
Winslow	82	33	59.5	4.61	
Maryland.					
Annapolis	92			7.00	
Bachmans Valley	93	42	68.4	5.13	
Boettcherville	104	38	70.4	3.00	
Boonsboro	96	43	71.0	3.30	
Cambridge	99	54	74.4	7.04	
Chase	90	42	69.5	4.35	
Cheltenham	97	42	69.7	5.05	
Chestertown	90	50	70.3	5.48	
Chewsville	94	40	69.0	4.28	
Clearspring	92	43	69.0	1.89	
Collegepark	97	43	70.8	4.10	
Colora				4.80	
Cumberland *b*				3.12	
Darlington	95	45	69.5	4.17	
Deerpark	87	31	61.2	4.96	
Denton	95	46	71.2	7.81	
Easton	91	49	72.1	7.38	
Fallston	93	45	69.4	5.58	
Frederick	99	47	72.4	4.59	
Grantsville	88	34	61.8	5.91	
Greatfalls	99	42	70.8	2.90	
Greenspring Furnace	96	40	69.0	3.82	
Guard	90	39	64.6	6.29	
Hancock	99	37	70.8	4.31	
Harney				3.96	
Jewell	94	51	71.9	7.68	
Johns Hopkins Hospital	94	52	72.2	4.17	
Laurel	98	42	70.2	4.11	
McDonogh	94	45	69.6	3.89	
Mount St. Marys College	93	48	70.6	4.09	
Newmarket	95	47	70.8	5.57	
Princess Anne	89	46	69.8	3.47	
Solomons	93	55	72.4	4.00	
Sudlersville	98	49	71.8	9.00	
Sunnyside	89	32	61.8	6.91	
Takoma Park	96	45	71.6	4.25	
Taneytown	96	41	69.6	4.23	
Van Bibber	89	47	70.6	5.57	
Westernport	97	37	68.0	3.36	
Woodstock	95	44	72.1	4.98	
Massachusetts.					
Bedford	86	47	62.6	1.81	
Bluehill (summit)	90	44	62.4	3.78	
Chestnuthill	92	45	65.6	2.69	
Cohasset				4.50	
Concord	90	42	62.8	1.89	
East Templeton *[1]	84	48	62.3	3.57	
Fallriver	86	49	64.0	3.52	
Fitchburg *a* *[1]	87	51	63.5	2.93	
Fitchburg *b*	90	43	63.2	2.85	
Framingham	92	43	65.4	2.42	
Groton	88	41	62.5	2.14	
Hyannis				5.11	
Jefferson				2.33	
Lawrence	91	44	64.1	2.50	
Leominster				1.95	
Lowell *a*	90	44	65.8	2.11	
Lowell *b*	91	43	64.7		
Ludlow Center	85	36	56.0	3.23	
Middleboro	89	39	63.1	4.89	
Monson	88	38	62.0	4.69	
New Bedford *a*	82	43	62.8	2.48	
Plymouth *[1]	90	52	64.4	3.68	
Princeton				3.09	
Provincetown	84	47	63.6	4.05	
Salem				2.19	
Somerset *[1]	93	48	67.6	4.55	
Springfield Armory	91	43	64.8	2.76	
Sterling				2.51	
Taunton *c*	90	37	63.2	4.87	
Webster				3.88	
Westboro	91	46	66.6	2.78	
Weston	89	43	62.8	2.52	
Williamstown	84	41	61.6	4.83	
Winchendon				3.71	
Worcester *b*	90	47	64.4	2.08	
Michigan.					
Adrian	89	40	64.8	10.03	
Agricultural College	89	39	61.8	7.28	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Allegan	90	39	63.4	5.20	
Alma	88	37	62.6	6.37	
Ann Arbor	87	42	63.5	7.56	
Annpere	92	44	65.0	2.50	
Arbela	87	40	61.8	10.20	
Baldwin	92	32	58.2	4.45	
Ball Mountain	85	38	61.4	10.40	
Battlecreek	90	43	64.0	8.05	
Bay City	87	40	62.2	6.50	
Benzonia	79	38	58.6	3.66	
Berlin	86	37	60.6	6.53	
Berrien Springs	91	43	64.2	8.60	
Big Rapids	83	35	60.0	5.03	
Birmingham	86	40	63.6	6.50	
Boon	81	34	56.7	5.19	
Calumet	74	36	54.2	3.30	
Cassopolis	90	34	62.0	7.70	
Charlevoix	82	40	57.2	2.90	
Charlotte	88	38	63.2	6.03	
Chatham	80	26	53.3	3.32	
Cheboygan	80	34	57.0	4.08	
Clinton	92	42	65.1	5.28	
Coldwater	91	40	64.0	7.40	
Deerpark	78	38	52.8	4.05	
Detour	70	41	54.0	4.12	
Dundee	88	43	64.0	9.54	
Eagle Harbor	75	34	52.4	3.65	
East Tawas	81	38	58.3	3.41	
Eloise	89	42	64.2	7.80	
Fennville	88	42	62.3	5.58	
Fitchburg	89	41	62.6	9.28	
Flint	86	41	61.7	7.20	
Gaylord	83	32	57.1	4.20	
Gladwin	87	40	61.2	3.45	
Grand Marais	75	34	52.4	4.03	
Grand Rapids	88	43	63.6	6.30	
Grape	90	42	64.2	9.44	
Grayling	83	36	57.4	4.10	
Hanover	88	39	62.4	7.02	
Harbor Beach	83	40	60.2	4.71	
Harrison	86	39	60.6	8.17	
Harrisville	87	40	57.6	4.11	
Hart	82	38	62.6	3.46	
Hastings	90	39	63.4	5.33	
Hayes	85	41	58.3	4.46	
Highland Station	......	......	......	7.85	
Hillsdale	90	38	63.1	7.18	
Humboldt	79	27	53.0	4.61	
Ionia	89	38	63.3	6.20	
Iron Mountain	80	34	58.3	2.83	
Iron River	79	28	57.8	5.15	
Ironwood	76	36	57.6	2.91	
Ishpeming	79	29	54.0	2.35	
Ivan	85	36	57.7	4.04	
Jackson	94	42	65.3	7.60	
Jeddo	85	39	59.9	6.35	
Kalamazoo	89	43	67.0	5.21	
Lake City	86	30	60.0	6.03	
Lansing	88	41	62.4	7.43	
Lathrop	80	28	53.5	2.67	
Lincoln	84	37	57.9	3.03	
Ludington	79	36	59.6	6.68	
Mackinac Island	79	28	52.4	4.05	
Mackinaw	72	42	57.4	4.56	
Mancelona	83	30	58.7	4.02	
Manistee	80	40	59.2	5.93	
Manistique	73	32	54.4	3.60	
Menominee	86	27	58.4	4.99	
Midland	89	39	62.1	4.24	
Mount Pleasant	86	36	62.3	5.66	
Muskegon	85	43	62.6	3.49	
Newberry	75	29	54.9	2.30	
North Marshall	90	40	63.2	7.05	
Old Mission	83	40	58.5	3.21	
Olivet	86	43	62.8	8.28	
Omer	86	37	59.8	2.63	
Onaway	84	32	57.6	3.22	
Ontonagon	79	37	55.0	2.06	
Ovid	87	39	62.0	5.25	
Owosso	89	40	63.7	5.19	
Petoskey	85	38	58.4	2.25	
Plymouth	90			5.53	
Port Austin	84	41	60.0	4.32	
Reed City	84	36	64.2	4.92	
Saginaw	88	41	63.2	5.78	
St. Ignace	79	40	56.6	3.87	
St. Johns	89	41	63.2	4.41	
St. Joseph	92	46	63.8	7.38	
Somerset [7]	87	40	62.2	5.37	
South Haven	87	44	60.4	5.07	
Stanton	92	40	63.0	6.15	
Thomaston	80	29	55.0	1.13	
Thornville	85	43	62.8	6.64	
Traverse City	88	39	60.0	2.89	
Vans Harbor	82	34	57.2	3.43	
Vassar	83	30	58.5	4.90	
Wasepi	87	42	63.8	8.36	
Waverly	90	43	63.8	5.62	
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Webberville	89	39	63.2	7.10	
West Branch	83	39	58.6	2.97	
Wetmore	81	25	54.9	......	
Whitecloud	85	33	62.2	3.30	
Whitefish Point	68	33	51.0	3.44	
Ypsilanti	86	41	62.9	7.86	
Minnesota.					
Ada	......	......	......	7.24	
Albert Lea	86	40	62.5	6.63	
Alexandria	85	38	60.7	3.07	
Angus	89	33	58.7	2.11	
Ashby	86	36	60.4	2.31	
Beardsley	89	34	60.0	3.01	
Beaulieu	84	35	57.7	4.20	
Bemidji	84	38	61.4	1.09	
Bird Island	82	36	59.7	2.13	
Blooming Prairie	84	39	61.8	4.05	
Brainerd	87	40	62.4	3.59	
Caledonia	87	38	62.8	4.34	
Campbell	87	38	62.6	1.39	
Cloquet	......	......	......	4.11	
Collegeville	87	42	62.7	2.08	
Crookston	88	36	60.2	2.35	
Currie	94	31	63.5	2.10	
Deephaven	......	......	......	2.60	
Detroit City	85	34	58.8	3.76	
Faribault	85	37	61.6	5.44	
Farmington	84	40	63.0	2.14	
Fergus Falls	89	37	61.6	3.60	
Glencoe	86	34	61.0	3.73	
Grand Marais	......	......	......	4.22	
Grand Meadow	86	35	62.5	6.07	
Hallock	81	31	57.4	3.12	
Hovland	......	......	......	4.39	
Hutchinson	86	38	63.0	2.25	
Lake Winnibigoshish	88	36	60.2	2.33	
Leech	86	34	60.8	1.98	
Long Prairie	87	38	61.1	6.90	
Luverne	84	35	59.0	2.58	
Lynd	91	35	61.4	2.12	
Mapleplain	89	40	63.5	2.94	
Milaca	84	38	60.0	4.96	
Milan	87	34	60.9	1.74	
Minneapolis *b* [1]	84	41	64.2	2.09	
Montevideo	91	36	62.4	2.08	
Morris	90	37	62.6	2.22	
Mount Iron	81	30	57.0	3.44	
New London	89	38	61.6	1.70	
New Richland	88	43	64.7	4.94	
New Ulm	91	39	64.4	5.76	
Park Rapids	84	36	59.4	2.88	
Pine River	84	39	62.0	6.54	
Pipestone	88	31	63.3	1.77	
Pleasant Mounds	84	37	61.6	8.53	
Pokegama Falls	90	31	59.9	2.44	
Redwing *a*	......	......	......	2.29	
Redwing *b*	85	48	67.6	2.60	
Reeds	......	......	......	3.79	
Rolling Green	87	37	62.6	2.54	
St. Cloud	88	40	61.9	2.92	
St. Peter	89	36	63.8	5.04	
Sandy Lake Dam	81	36	59.5	3.69	
Shakopee	85	42	63.6	3.06	
Tower	85	29	54.6	2.00	
Two Harbors	83	34	53.0	3.00	
Wabasha	88	40	65.4	2.80	
Willmar	89	37	62.2	1.19	
Willow River	85	33	58.9	3.77	
Winnebago City	93	38	63.8	5.13	
Winona	83	43	65.0	4.29	
Worthington	89	36	62.2	2.18	
Zumbrota *[1]	82	36	63.5	......	
Mississippi.					
Aberdeen	106	53	82.0	2.74	
Agricultural College	99	56	82.0	1.93	
Austin	95	51	77.5	6.19	
Batesville	100	49	79.9	2.01	
Bay St. Louis	100	66	83.1	2.05	
Biloxi	98	65	83.0	1.16	
Booneville	101	52	78.1	3.24	
Brookhaven	103	57	82.4	2.04	
Canton	100	52	81.6	0.27	
Columbus *b*	99	56	80.6	0.74	
Corinth	98	49	77.4	3.26	
Crystalsprings	101	56	82.6	0.40	
Duck Hill	103	47	81.3	0.02	
Edwards	99	56	82.8	0.57	
Fayette	98	52	80.2	1.00	
Fayette (near) *[1]	98	65	84.2	0.87	
Greenville *a*	93	59	80.2	0.97	
Greenville *b*	105	58	83.4	0.84	
Greenwood	100	51	81.0	0.62	
Hattiesburg	103	55	83.4	1.31	
Hazlehurst	101	57	81.8	1.11	
Hernando	97	55	78.0	5.61	
Holly Springs	99	54	78.9	5.55	
Indianola	99	52	79.4	1.95	
Jackson	104	54	83.6	1.65	
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kosciusko	103	54	82.0	1.66	
Lake	100	52	80.8	0.37	
Leakesville	103	55	82.3	0.76	
Louisville	100	55	81.2	1.08	
Macon	104	48	82.0	0.74	
Magnolia	101	53	81.3	0.43	
Natchez	99	60	81.8	1.40	
Nittayuma	100	54	81.5	0.78	
Okolona	105	53	82.0	0.60	
Palo Alto	99	55	82.2	0.95	
Patmos	......	......	......	1.76	
Pearlington	101	61	82.4	0.24	
Pittsboro	102	51	80.3	1.87	
Pontotoc	99	52	79.4	2.49	
Port Gibson	100	52	82.1	0.26	
Ripley	97	52	78.2	2.85	
Shoccoe	......	......	......	T.	
Stonington *[1]	96	58	82.4	0.25	
Suffolk	99	55	80.8	1.56	
Swartwout	99	62	81.3	2.60	
Thornton	98	62	83.2	1.52	
Tupelo	100	55	81.6	2.06	
University	101	52	79.6	2.05	
Walnutgrove	100	58	81.2	1.20	
Watervalley	103	52	83.0	1.70	
Waynesboro	100	56	81.5	2.20	
Woodville	101	58	83.0	0.47	
Yazoo City	100	53	82.3	0.27	
Missouri.					
Appleton City	92	45	71.5	4.62	
Arthur	92	42	71.5	5.84	
Avalon	93	40	69.1	4.53	
Bagnell	......	......	......	8.33	
Bethany	91	42	67.4	9.93	
Birchtree	93	48	73.2	7.45	
Boonville	......	......	......	4.74	
Brunswick	96	44	69.4	5.15	
Carrollton	......	......	......	7.60	
Conception	91	39	65.4	7.18	
Cowgill *[5]	96	54	69.1	7.67	
Darksville	92	44	69.3	6.40	
Dean	96	41	73.3	8.14	
Desoto	97	47	72.6	5.69	
Downing	......	......	......	6.89	
Edgehill *[5]	94	54	73.7	6.44	
Edwards	92	37	71.0	6.01	
Eightmile [3]	......	......	67.0	6.11	
Eldon	93	40	70.2	7.97	
Fairport	......	......	......	7.44	
Fayette	97	45	71.6	3.75	
Fulton	93	42	71.0	5.04	
Galena	......	......	......	6.29	
Gallatin *[1]	92	48	66.2	5.75	
Glasgow	95	44	69.8	3.76	
Gorin	......	......	......	6.18	
Grant City	......	......	......	11.97	
Halfway	94	44	71.4	9.26	
Harrisonville	95	44	70.4	4.29	
Hazlehurst	......	......	......	5.62	
Hermann	......	......	......	7.31	
Houston	95	43	73.1	7.19	
Ironton	97	44	72.4	5.40	
Jackson	97	45	74.6	5.03	
Jefferson City	97	42	71.8	8.89	
Joplin	92	48	73.5	10.19	
Kidder	95	43	68.0	4.31	
Koshkonong	93	49	73.4	4.48	
Lamar	96	46	72.8	8.26	
Lamonte	......	......	......	2.55	
Lebanon	93	45	72.3	9.12	
Lexington	96	43	70.4	6.07	
Liberty	95	44	69.5	4.57	
Louisiana	94	40	70.0	7.68	
McCune	94	43	69.8	6.44	
Marblehill	98	44	73.6	3.83	
Marshall	94	43	69.8	3.79	
Maryville	95	42	66.8	7.70	
Mexico	94	43	69.8	8.79	
Miami *[5]	97	53	71.7	4.50	
Mineralspring	93	45	73.0	8.52	
Monroe City	94	44	69.4	5.73	
Montreal	92	40	70.6	8.78	
Mountaingrove	96	43	72.0	5.75	
Mount Vernon	95	44	73.3	12.55	
Neosho	94	42	73.4	9.28	
Nevada	......	......	......	5.14	
New Haven	97	47	73.0	6.89	
New Madrid *b*	......	......	......	2.76	
New Palestine	94	45	70.4	4.05	
Oakfield	96	46	72.2	6.19	
Olden	93	53	73.8	4.57	
Oregon	93	47	67.6	7.52	
Palmyra *[5]	92	52	70.6	5.67	
Phillipsburg	......	......	......	8.58	
Pine Hill	......	......	......	5.10	
Poplarbluff	98	48	75.4	5.87	
Potosi (near)	94	43	70.4	6.48	
Princeton	98	45	69.0	10.59	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Richmond	95	49	70.6	5.49	
Rockport				7.08	
Rolla				8.15	
St. Charles	100	45	72.9	7.34	
St. Joseph				6.93	
Sarcoxie [3]		50	69.6	11.25	
Sedalia	93	44	71.6	3.62	
Seymour	91	41	70.0	8.80	
Shelbina				7.89	
Sikeston	96	48	74.1	3.64	
Steffenville	95	43	69.4	6.84	
Sublett	98	39	68.8	8.69	
Trenton	92	44	69.0	5.49	
Unionville	98	42	68.3	8.52	
Vichy	93	43	70.9	8.39	
Warrensburg	94	45	70.2	4.26	
Warrenton	97	45	71.5	5.04	
Wheatland				5.44	
Willowsprings	94	42	72.2	6.16	
Windsor	93	44	71.4	5.08	
Zeitonia	99	46	73.0	6.72	
Montana.					
Adel	81[h]	21[h]	47.4[h]	2.48	
Anaconda [f]	89	28	53.8	1.32	
Augusta	83	27	53.2	0.79	
Billings	100	36	61.6		
Boulder	90	27	54.5	0.70	
Bozeman	87	30	55.1	2.60	
Butte	84	31	54.6	0.75	
Canyon Ferry	93	37	60.0	0.86	
Chester	90	27	57.4	3.64	
Columbia Falls	89	28	53.6	3.66	
Crow Agency	95	32	62.8	1.10	
Culbertson	86	32	57.4	3.91	
Deerlodge	86	30	54.2		
Dell	87[e]	29[e]	56.6[e]	0.16	
Dillon	88	30	56.2	1.74	
Ekalaka	91	31	59.4	1.41	
Fort Benton	88	36	57.0		
Fort Logan	84	27	51.4	1.75	
Glasgow	88	30	57.8	1.77	
Glendive	94	34	59.2	2.87	
Greatfalls	86	34	57.4	4.02	
Kipp	82	26	50.2	3.35	
Lewistown	88	31	55.4	6.00	
Livingston	99	31	58.8	1.75	
Manhattan [4]	92	31	60.4	1.31	
Marysville	87	28	57.4	0.62	0.2
Missoula	90	32	57.8	0.48	
Parrot	91	33	58.3	1.09	
Plains	84	30	54.7	1.03	
Poplar	89	34	58.4	2.81	
Ridgelawn	89	33	58.6	3.77	
St. Pauls	89	30	54.0	4.01	2.0
St. Peter	81	23	50.2	4.25	0.5
Springbrook	95	31	58.3	3.14	
Toston	92	30	56.8	1.12	
Townsend	90	28	56.7	1.47	
Troy	87	30	55.1	0.62	
Twin Bridges	89	33	57.2	0.70	
Twodot	85	25	55.4	0.95	
Utica	90	29	55.7	3.28	
Wibaux	85	26	58.6	2.95	T.
Yale	87	21	53.7	2.98	
Nebraska.					
Agate				4.71	
Agee *[1]	93	48	65.5	3.32	
Albion	93	37	65.4	3.38	
Alliance	101	36	67.2	4.45	
Alma	103	36	69.8	4.30	
Ames	95	40	67.4	6.76	
Ansley	98	35	66.1	4.08	
Arapahoe *[1]	102	48	72.0		
Arborville *[1]	92	40	64.6	11.15	
Arcadia	104	36	66.2	3.25	
Ashland *a*	98	42	68.2	8.72	
Ashland *b* *[1]	98	42	68.6	9.20	
Ashton				6.58	
Auburn	99	41	68.2	9.42	
Aurora	95	43	66.2	6.85	
Bartley				3.22	
Beatrice	98	40	68.3	10.17	
Beaver	99	39	68.2	4.26	
Bellevue				6.73	
Benedict				9.90	
Benkleman	102	42	66.6	2.70	
Blair	90	43	65.4	7.91	
Bluehill *[1]	98	40	69.0	5.05	
Bradshaw				8.97	
Bridgeport	104	35	67.7	5.10	
Brokenbow	101	33	65.2	2.76	
Burchard				8.10	
Burwell				5.32	
Callaway	92	32	66.5	3.95	
Central City				7.51	
Chester				7.17	
Cody				2.46	
Columbus	94	40	66.2	7.83	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Crete	89	40	65.8	8.36	
Culbertson				4.19	
Curtis	100[g]	35[g]	67.3[g]	2.98	
Dannebrog				5.63	
Dawson	95	43	68.8	6.73	
Edgar				6.33	
Ericson				4.05	
Ewing				3.67	
Fairbury	99	38	67.2	12.59	
Fairmont	94	38	65.6	10.78	
Fort Robinson	100	33	65.6	3.74	
Franklin	100	36	68.1	6.95	
Fremont	93	40	67.0	6.68	
Fullerton				8.13	
Geneva	95	38	67.0	9.23	
Genoa (near)	92	40	65.9	9.37	
Gering	101	36	67.9	3.63	
Gosper				6.76	
Gothenburg	101	35	65.6	2.71	
Grand Island *a*				5.38	
Grand Island *b*	96	36	66.8	6.59	
Grand Island *c*	101	37	67.1	6.35	
Greeley				3.36	
Guide Rock	102	44	72.2	3.62	
Haigler				2.16	
Harbine				9.77	
Hartington	92	39	64.2	3.44	
Harvard	98	38	66.4	5.81	
Hastings *[1]	94	46	66.9	6.74	
Hayes Center				3.72	
Hay Springs	99[i]	34[i]	62.1[i]	5.25	
Hebron	97	39	67.3	7.70	
Holbrook				3.45	
Holdrege	98	38	67.4	7.18	
Hooper *[1]	91	49	66.2	6.45	
Imperial	104	37	68.1	4.67	
Johnstown				2.24	
Kearney	93[m]	46[m]	68.9[m]	4.71	
Kennedy	101	32	64.6	4.04	
Kimball	100	38	65.4	1.59	
Kirkwood *[1]	97[e]	45[e]	64.9[e]	1.65	
Laclede	98	38	65.4	6.93	
Lexington	102	33	64.7	2.98	
Loup	96	34	65.4	6.46	
Lynch	102	31	67.8	1.71	
Lyons				5.46	
McCook *[1]	96	44	67.4	2.82	
McCool				10.20	
Madison	92	39	64.5	6.65	
Madrid	105	42	68.9	3.15	
Marquette				7.57	
Mason City				6.05	
Minden *a*	95	35	65.2	6.33	
Monroe				10.66	
Nebraska City *b* *[1]	98	48	66.2	11.73	
Nemaha *[1]	96	54	71.6	6.75	
Nesbit	102	31	63.3	1.94	
Norfolk	98	36	65.4	7.11	
North Loup	96	32	64.8	4.89	
Oakdale	95	38	65.0	5.29	
Odell				10.73	
O'Neill	102	34	63.9	4.12	
Ord	92	34	64.6	2.55	
Osceola				8.28	
Palmer				8.24	
Palmyra *[1]	92	48	66.9	9.06	
Plattsmouth *a*				7.82	
Plattsmouth *b*	97	43	64.8	7.81	
Purdum	102	34	64.8	4.09	
Ravenna *a*	96	35	65.8	3.89	
Ravenna *b*				3.46	
Redcloud *b*				7.75	
Republican *[1]	100	48	70.4	3.98	
Rulo				5.90	
St. Libory	94	40	67.4	7.21	
St. Paul	96	37	66.6	10.30	
Salem *[1]	96	50	69.8	7.99	
Santee	95	40	66.2	6.31	
Schuyler				5.96	
Seward	98	40	67.0	8.73	
Smithfield				4.39	
Springview	96	35	63.2	1.40	
Stanton	91	40	65.0	5.48	
State Farm	97	39	68.0	8.60	
Strang *[1]	95	50	68.8	10.48	
Stratton				3.35	
Superior	103	40	68.0	8.69	
Syracuse				8.87	
Tablerock	95	41	67.4	9.79	
Tecumseh *b*	98	43	66.6	11.84	
Tecumseh *c*				12.44	
Tekamah	92	42	67.5	5.48	
Turlington	96	41	67.0	7.97	
Wakefield	96	37	65.0	5.24	
Wallace				3.62	
Wauneta				5.25	
Weeping Water	93	40	65.0	9.00	
Westpoint	95	38	67.0	6.66	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wilber *[1]	96	42	67.4	12.89	
Willard				3.42	
Wilsonville	96	50	72.6	3.93	
Winnebago				4.19	
Wisner				5.23	
Wymore	96	51	69.4	7.88	
York	96	40	68.2	9.70	
Nevada.					
Austin	89	31	62.9	0.00	
Battle Mountain	102	29	68.6	0.00	
Belmont	89	30	64.5	T.	
Butler	93	30	68.2	0.00	
Candelaria	98	33	71.2	0.13	
Carlin				0.00	
Carson City	92	29	61.6	T.	
Elko				0.12	
Elko (near)	94	26	61.0	0.05	
Ely	95	27	64.6	0.03	
Eureka	95	27	64.3	0.30	
Fenelon *[1]	95	30	63.9		
Golconda *[1]	97	43	66.8	T.	
Halleck *[1]	96	33	60.2	0.00	
Hamilton	80	25	54.9	0.25	
Hawthorne	98	35	69.4	0.00	
Humboldt	94	42	68.2	0.00	
Lee				0.25	
Lewers Ranch	90	29	62.3	0.00	
Lovelocks	98	34	72.1	0.00	
Martins	96	29	64.2	0.00	
Mill City *[1]	98	40	72.6	0.00	
Monitor Mill	90	29	60.6	0.07	
Palisade	97	29	64.2	0.18	
Palmetto	94	20	63.1	T.	
Reno State University	91[e]	31[e]	66.4[e]	0.00	
Rioville	116	49	86.6	0.00	
Silverpeak	99	39	74.2	0.00	
Sodaville	104	37	74.7	0.00	
Tecoma	101	28	65.6	T.	
Toano				0.00	
Tybo	95	32	69.0	T.	
Wabuska	100	32	67.0	0.00	
Wadsworth	96	34	68.0	0.00	
Wells *[1]	94	42	64.9	0.00	
Wood	92	27	61.0	0.00	
New Hampshire.					
Alstead	85	37	60.6	4.84	
Berlin Mills	86	30	58.8	4.05	
Bethlehem	84	34	58.2	5.30	
Brookline *[1]	92	35	64.0	3.06	
Chatham	87	36	59.2	5.20	
Claremont	89	37	62.2	5.10	
Concord	88	35	61.4	3.12	
Durham	90	39	61.0	4.04	
Franklin Falls	85	40	61.0	4.75	
Grafton	86	31	58.8	4.02	
Hanover	87	36	60.2	3.81	
Keene	88	33	60.9	3.98	
Littleton	82	35	57.6	4.56	
Nashua	94	42	65.2	2.05	
Newton	90	37	60.7	3.29	
Peterboro	87	32	60.6	3.15	
Plymouth	89	34	61.0	4.52	
Sanbornton	84	35	58.8	4.17	
Stratford	83	32	58.4	5.04	
New Jersey.					
Asbury Park	89	48	65.2	7.91	
Bayonne	92	49	68.5	6.78	
Belvidere	91	44	67.5	6.65	
Bergen Point	91	42	67.6	6.49	
Beverly	93	49	69.6	6.02	
Blairstown	93	40	65.2	5.47	
Bridgeton	98	48	72.5	7.23	
Camden	94	49	69.7	6.59	
Cape May C. H.	94	46	68.7	5.88	
Charlotteburg	88	37	63.5	6.61	
Chester	90	42	64.5	5.27	
Clayton	95	48	69.6	7.63	
College Farm	94	44	68.6	6.08	
Culvers Lake				5.42	
Dover	92	41	65.3	5.35	
Egg Harbor City				9.13	
Elizabeth	94	48	68.8	6.94	
Englewood	89	48	67.6	6.71	
Flemington	94	45	68.4	5.03	
Freehold	91	45	67.4	6.33	
Friesburg	95	43	69.3	9.30	
Hanover	90	42	65.8	6.17	
Hightstown	92	48	69.0	6.93	
Imlaystown	94	46	69.6	5.11	
Indian Mills	95	44	69.4	8.58	
Lakewood	93	46	67.3	8.05	
Lambertville	92	48	68.2	6.33	
Layton	90	38	64.2	4.54	
Moorestown	91	48	68.3	7.30	
Mount Pleasant				6.83	
Newark	93	46	67.6	7.15	
New Brunswick	93	47	69.0	6.35	
New Egypt				6.30	

Table II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
New Jersey—Cont'd.					
Newton	92[d]	43[e]	64.8[d]	6.60	
Oceanic	92	48	67.8	6.58	
Paterson	95	48	68.8	6.23	
Pemberton	95	45	68.4	6.71	
Plainfield	93	45	67.1	5.67	
Rancocas	96	52	......	6.86	
Ringwood	94	39	65.0	5.93	
Rivervale	97	38	65.2	5.77	
Roseland	91	41	65.3	5.86	
Salem	95	48	70.4	8.02	
Somerville	97	43	68.4	5.33	
South Orange	90	46	66.8	6.08	
Sussex	89	43	65.4	5.12	
Three Bridges	......	......	......	5.28	
Trenton	92	50	69.2	5.67	
Tuckerton	93	42	68.0	7.89	
Vineland	99	47	70.0	8.16	
Woodbine	92	44	67.8	6.74	
Woodstown	......	......	......	10.21	
New Mexico.					
Alamagordo	108	54	82.4	0.17	
Albert	108	47	75.4	0.47	
Albuquerque	100	49	75.6	T.	
Arabela	101	46	73.8	0.83	
Aztec	101	41	71.4	0.45	
Bellranch	......	......	......	1.72	
Bluewater	103	34	70.4	T.	
Cambray	......	......	......	0.32	
Carlsbad	112	54	82.8	3.54	
Deming	......	......	......	0.00	
East View	96	43	70.0	0.76	
Engle	101	50	75.8	T.	
Espanola	101	40	72.4	0.05	
Folsom	94	38	65.4	1.10	
Fort Bayard	98	46	72.4	0.53	
Fort Stanton	105	40	70.8	0.24	
Fort Union	95	43	66.8	0.15	
Fort Wingate	94	29	65.1	T.	
Gage	......	......	......	0.24	
Galisteo	95	49	71.2	0.00	
Gallinas Spring	105	43	75.9	0.60	
Horse Springs	97	36	67.5	0.11	
Las Vegas	98	44	71.2	0.30	
Las Vegas Hot Springs	94	45	67.8	T.	
Lordsburg	......	......	......	0.20	
Los Lunas	103	50	75.7	T.	
Mesilla Park	106	44	77.9	0.07	
Olio	108	35	71.8	T.	
Raton	97	40	69.4	0.30	
Roswell	107	51	76.6	1.03	
San Marcial	113	45	85.5	T.	
Socorro	106	51	80.4	0.13	
Springer	......	......	......	0.07	
Taos	98	37	69.0	T.	
Winsors	87	27	57.0	0.49	
Woodbury	102	47	73.6	0.07	
New York.					
Addison	88	35	62.9	5.37	
Adirondack Lodge	78	31	54.0	7.59	
Akron	......	......	......	4.28	
Alden	84	38	61.6	4.98	
Angelica	86	29	60.4	5.79	
Appleton	86	36	60.6	4.54	
Arcade	81	30	58.8	6.15	
Athens	90	46	64.8	5.04	
Atlanta	86	33	60.4	5.19	
Auburn	88	38	62.9	6.62	
Avon	85	35	61.8	3.75	
Axton	84	28	56.4	5.38	
Baldwinsville	86	41	62.6	6.00	
Bedford *a*	89	40	64.1	4.75	
Blue Mountain Lake	......	......	......	5.50	
Bolivar	83	29	59.9	6.66	
Bouckville	84	39	60.2	6.25	
Brockport	87	40	61.8	4.61	
Caldwell	86	39	60.4	4.65	
Canaan Four Corners	85	40	60.4	7.01	
Canajoharie	84	37	61.0	3.64	
Canton	87	32	59.5	5.67	
Carmel	89	48	66.2	4.98	
Carvers Falls	86	37	60.2	4.79	
Cedarhill	89	43	63.5	3.54	
Cooperstown	83	40	60.0	5.43	
Cortland	86	31	61.6	5.03	
Cutchogue	83	48	64.3	5.61	
Dekalb Junction	......	......	......	4.62	
Easton	......	......	......	4.00	
Elba	82	38	59.2	4.05	
Elmira	87	40	65.0	4.12	
Fayetteville	88	39	62.5	6.10	
Franklinville	83	32	59.7	4.68	
Gabriels	82	30	56.2	5.04	
Gansevoort	......	......	......	3.73	
Glens Falls	89	42	63.7	4.30	
Gloversville	85	38	60.5	5.48	
Greenwich	85	40	60.5	3.02	
Griffin Corners	81	34	58.2	6.28	
Harkness	84	31	61.2	4.08	
New York—Cont'd.					
Haskinville	......	......	......	5.30	
Hemlock	81	43	63.0	4.63	
Honeymead Brook	89	41	63.4	4.87	
Humphrey	80	34	59.6	6.72	
Indian Lake	80	29	55.4	5.63	
Ithaca	85	39	62.2	5.39	
Jamestown	86	34	61.2	5.23	
Keene Valley	85	32	59.2	5.46	
King Ferry	......	......	......	4.17	
Liberty	84	36	61.8	5.44	
Littlefalls, City Res.	85	40	60.2	6.40	
Lockport	84	41	62.2	4.03	
Lowville	84	35	59.5	4.75	
Lyndonville	......	......	......	4.25	
Lyons	87[g]	42[g]	64.0[g]	3.39	
Meredith	80	35	57.4	8.37	
Middletown	88	46	64.9	3.38	
Mohonk Lake	84	45	62.6	5.57	
Moira	84	35	59.6	4.29	
Newark Valley	......	......	......	7.26	
New Lisbon	83	33	58.0	4.61	
North Hammond	82	42	61.8	3.90	
Number Four	81	34	55.6	5.04	
Nunda	......	......	......	5.16	
Ogdensburg	85	40	61.7	4.48	
Old Chatham	......	......	......	6.26	
Oneonta	87	39	61.8	4.96	
Oxford	83	37	61.0	6.46	
Palermo	85	36	......	5.57	
Penn Yan	85[b]	42[e]	63.8[e]	4.30	
Perry City	85	32	61.4	5.52	
Plattsburg Barracks	88	37	59.4	3.74	
Port Jervis	91	43	64.8	4.81	
Primrose	92	45	67.2	6.25	
Redhook	......	......	......	4.59	
Richmondville	88	39	62.0	4.81	
Ridgeway	83	41	61.5	4.29	
Rome	86	40	62.3	6.79	
Romulus	85	39	62.4	5.95	
Salisbury Mills	......	......	......	4.23	
Saranac Lake	82	32	57.8	5.76	
Saratoga Springs	89	41	62.6	3.73	
Scottsville	......	......	......	4.06	
Setauket	89	46	65.8	5.09	
Shortsville	83	40	62.2	4.36	
Skaneateles	......	......	......	7.70	
Southampton	81	44	63.4	6.19	
South Canisteo	89	30	60.7	6.24	
South Kortright	84	35	59.0	8.41	
South Schroon	82	33	58.3	5.16	
Straits Corners	85[e]	32[e]	61.2[e]	5.27	
Ticonderoga	91	41	63.0	3.44	
Volusia	91	42	60.6	5.63	
Walton	85	36	59.6	7.55	
Wappingers Falls	87	46	65.8	4.97	
Warwick	......	......	......	4.00	
Watertown	89	39	61.3	5.84	
Waverly	89	33	63.5	5.50	
Wedgwood	85	38	61.0	6.25	
Wells	85	32	58.4	5.14	
West Berne	87	35	60.6	3.47	
West Chazy	84	39	60.4	......	
Westfield *b*	83	43	61.4	4.41	
Westfield *c*	82	41	61.8	4.97	
Windham	86	36	60.8	4.65	
Wolcott	86	39	60.9	5.78	
North Carolina.					
Brevard	95	45	70.8	8.92	
Bryson City	......	......	......	4.32	
Chapelhill	99	53	76.7	3.10	
Cherryville	100[d]	54[d]	73.4[d]	5.35	
Cranberry	78	48	66.0	8.03	
Currituck	......	......	......	2.52	
Durham	......	......	......	4.91	
Edenton	93	52	76.4	5.65	
Fayetteville	97	53	77.4	2.37	
Flatrock	94	44	69.8	6.01	
Goldsboro	94	53	76.3	4.17	
Greensboro	93	53	73.1	5.76	
Henderson	96	55	75.6	4.77	
Hendersonville	94	48	71.2	5.51	
Henrietta	99	52	76.5	5.25	
Highlands	87	46	66.3	6.49	
Horse Cove	85	45	68.2	2.96	
Hot Springs	95	50	72.8	......	
Kinston	100	50	77.5	3.92	
Lenoir	96	47	70.8	6.00	
Linville	80	36	63.2	7.49	
Littleton	98	50	73.8	4.86	
Louisburg	96	53	76.2	3.64	
Lumberton	95	57	77.8	2.29	
Marion	95	47	72.8	5.98	
Mocksville	92	48	69.7	5.75	
Moncure	99	49	76.7	3.11	
Monroe	99	50	75.8	3.29	
Morganton	98	47	73.4	5.18	
Mountairy	93	46	70.8	3.55	
Murphy	......	......	......	3.24	
North Carolina—Cont'd.					
Newbern	92	52	75.7	5.34	
Oakridge	99	51	73.9	4.89	
Patterson *[1]	90	45	69.7	4.77	
Penelo	97	46	76.6	3.47	
Pittsboro	100	48	75.9	2.23	
Red Springs	96	51	77.6	2.54	
Reidsville	......	......	......	4.85	
Rockingham	96	56	76.4	2.32	
Roxboro	96	50	74.4	3.14	
Salem	96	50	74.4	5.60	
Salisbury	100	50	77.3	7.85	
Saxon	98	42	71.8	6.15	
Selma	102	49	77.8	3.12	
Settle	98	52	75.2	9.72	
Sloan	96	52	76.3	3.10	
Soapstone Mount	96	46	73.6	4.34	
Southern Pines *a*	103	55	80.0	2.89	
Southern Pines *b*	98	55	77.7	2.42	
Southport	94	63	78.8	4.23	
Springhope *[1]	99	58	75.2	5.93	
Statesville	98	47	73.4	8.69	
Tarboro	101[h]	49[h]	78.6[h]	......	
Weldon *a*	94	53	74.4	3.66	
Weldon *b*	......	......	......	3.44	
North Dakota.					
Amenia	89	35	60.0	5.36	
Ashley	93	30	57.8	2.60	
Berlin	90	30	56.9	4.01	
Buxton	87[d]	35[d]	60.0[d]	2.04	
Churchs Ferry	81	34	55.8	3.45	
Coalharbor	89	35	58.9	4.40	
Devils Lake	88	34	58.4	3.99	
Dickinson	84[e]	35[e]	56.0[e]	2.56	
Donnybrook	......	......	......	3.11	
Dunseith	75	28	51.0	4.00	
Edgeley	92	35	59.8	5.90	
Ellendale	94	32	59.6	2.75	
Falconer	89[e]	32[e]	58.8[e]	6.30	
Fargo	88	31	58.2	3.07	
Forman	89	32	58.9	3.16	
Fort Yates	94	32	60.4	3.49	
Fullerton	91	31	58.5	3.29	
Gallatin	85	28	54.6	2.45	
Glenullin	89	34	58.0	5.49	
Grafton	83	36	60.4	2.40	
Hamilton	58	31	58.1	4.10	
Hannaford	92	32	57.8	2.57	
Jamestown	91	33	58.1	3.52	
Langdon	81	32	55.2	4.55	
Larimore	86	33	57.4	2.88	
Lisbon	88	30	58.6	3.81	
McKinney	86	35	55.3	1.50	
Mayville	91	35	60.4	2.51	
Medora	89	33	59.6	1.65	
Melville	88	34	59.4	3.66	
Milton	80	33	56.4	3.17	
Minnewaukon	89	33	58.2	3.18	
Minot	87	35	60.2	......	
Minto	86	30	57.8	3.94	
Napoleon	97	31	59.8	4.18	
New England	86	28	56.4	1.00	
Oakdale	85	35	56.6	4.46	
Pembina	82	31	58.2	3.79	
Portal	82	35	54.4	6.14	
Power	89	32	59.8	2.66	
Steele	92	32	59.7	4.91	
University	87	40	59.8	2.09	
Valley City	90	32	58.9	4.83	
Wahpeton	86	35	62.0	2.48	
Willow City	75[n]	34[n]	54.0[n]	4.69	
Woodbridge	82	31	55.3	4.47	
Ohio.					
Akron	87	43	64.2	7.29	
Annapolis	86	40	64.5	6.20	
Atwater	......	......	......	7.93	
Bangorville	94	38	65.7	5.51	
Bellefontaine	88	43	66.6	7.41	
Bement	......	......	......	7.45	
Benton Ridge	92	40	66.6	6.55	
Bethany	95	47	71.5	7.02	
Binola	......	......	......	9.28	
Blaine	......	......	......	6.77	
Bloomingburg	......	......	......	6.85	
Bowling Green	90	37	65.0	10.18	
Bucyrus	92	42	65.3	7.97	
Cambridge	95	39	66.9	8.35	
Camp Dennison	97	43	71.3	6.17	
Canal Dover	90	38	65.8	4.85	
Canton	90	43	66.3	5.55	T.
Cardington	92	36	65.4	5.20	
Cedarville	86	44	......	6.79	
Chillicothe	99	42	70.5	7.29	
Circleville	94	45	69.2	7.71	
Clarksville	94	44	69.7	8.30	
Cleveland *a*	86	46	65.0	9.81	
Cleveland *b*	88	44	65.0	9.43	
Clifton	90	42	67.2	8.36	
Coalton	96	41	69.0	7.51	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Ohio—Cont'd.					
Colebrook	86	55	62.4	5.15	
Dayton *a*				7.79	
Dayton *b*	95	43	69.8	7.32	
Defiance	93	39	65.3	7.97	
Delaware	95	38	66.5	7.18	
Demos	93	46	67.6	6.34	
Dunham				5.18	
Elyria	90	42	64.4	9.83	
Findlay	98	42	67.8	7.21	
Frankfort	92	42	67.8	6.10	
Fremont	92	43	66.9	10.56	
Garrettsville	87	36	63.6	7.05	
Granville	94	41	66.6	7.67	
Gratiot	92	43	67.1	8.68	
Green	94	46	71.5	5.55	
Greenfield	92	45	69.0	6.43	
Greenhill	89	37	62.8	5.69	
Greenville	93	46	69.0	6.79	
Hanging Rock	97	45	69.0	7.25	
Hedges	95	37	66.4	6.19	
Hillhouse	89	34	62.2	7.94	
Hiram	88	42	63.6	8.89	
Hudson	89	38	63.0	7.70	
Jacksonboro	96	46	68.9	9.57	
Killbuck	92	39	65.6	3.21	
Lancaster	94	44	67.6	8.85	
Lima	95	40	67.2	6.70	
McConnellsville	92	43	67.0	7.27	
Manara	95	44	68.6	10.14	
Mansfield				6.25	
Marietta	91	48	69.0	8.26	
Marion	96	40	67.3	7.17	
Medina	90	40	66.4	8.05	
Milfordton	92	39	64.8	6.61	
Milligan	95	40	66.8	9.36	
Millport	87	38	64.2	5.71	
Montpelier	90	39	63.0	9.77	
Napoleon	90	41	66.4	7.91	
New Alexandria	95	44	67.6	5.15	
New Berlin	88	40	65.0	6.95	
New Bremen	94	36	68.3	7.81	
New Lexington				9.74	
New Paris	92	44	68.0	8.72	
New Richmond	95	48	71.8	4.85	
New Waterford	89	40	66.8	6.05	
North Lewisburg	93	44	67.3	8.20	
North Royalton	88	41	64.2	8.22	
Norwalk	95	42	66.8	9.97	
Oberlin	92	42	65.3	9.15	
Ohio State University	94	41	67.4	9.20	
Orangeville	89	33	63.3	4.48	
Ottawa	92	39	66.0	5.79	
Pataskala	93	42	66.9	8.99	
Philo	98	43	69.8	8.95	
Plattsburg	94	41	68.2	8.23	
Pomeroy	98	44	69.0	4.90	
Portsmouth *a*				5.39	
Portsmouth *b*	97	48	72.3	5.37	
Pulse				7.05	
Red Lion				10.46	
Richfield				9.26	
Richwood	95	39	67.6	6.38	
Ripley	92	41	69.2	5.15	
Rittman	95	40	66.1	7.25	
Rock				5.28	
Rockyridge	91	42	67.6	7.47	
Shenandoah	92	40	64.8	7.24	
Sidney	95	41	68.6	5.91	
Somerset	97	45	69.6	8.44	
Springfield				8.65	
Strongsville				9.34	
Swanton				7.49	
Thurman	92	44	69.8	7.94	
Tiffin	92	46	67.0	10.31	
Upper Sandusky	96	42	67.4	8.02	
Urbana	89	44	66.3	7.86	
Vickery	92	42	65.8	9.20	
Walnut				9.52	
Warren	90	38	64.8	5.41	
Warsaw	94	35	65.6	5.41	
Wauseon	93	41	65.6	7.73	
Waverly	98	43	70.7	8.16	
Waynesville	94	45	68.0	10.35	
Wellington	90	42	66.4	10.88	
Willoughby				7.41	
Wooster	89	39	65.6	5.55	
Zanesville				7.05	
Oklahoma.					
Arapaho	106	45	76.2	0.77	
Beaver	104	51	74.3	1.89	
Blackburn	97	43	73.9	5.57	
Burnett	104	54	79.6	1.21	
Chandler	97	48	77.4	1.19	
Clifton	100	44	77.7	1.38	
Cloud Chief	102	47	76.6	1.35	
Enid	98	45	74.8	1.23	
Fort Reno	98	56	76.8	0.30	
Fort Sill	107	48	78.3	0.20	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Oklahoma—Cont'd.					
Guthrie	95	54	76.9	2.71	
Hennessey	97	57	76.6	2.67	
Jefferson	99	47	75.7	3.98	
Jenkins	98	47	75.0	2.32	
Kenton	105	50	74.0	1.12	
Kingfisher	99	46	77.4	1.18	
Mangum	106	57	80.2	1.15	
Newkirk	99	48	75.9	5.95	
Norman	103	47	76.9	0.66	
Pawhuska	101	46	78.2	4.43	
Perry	97	49	75.6	2.49	
Sac and Fox Agency	101	47	78.0	2.06	
Shawnee	101	48	78.4	0.72	
Stillwater	98	48	75.9	2.19	
Taloga	98	43	75.0	0.72	
Waukomis	98	49	76.4	2.45	
Weatherford	102	47	78.3	0.91	
Oregon.					
Albany *a*	86	47	60.8	0.36	
Albany *b*				0.66	
Alpha	89	35	57.4	1.36	
Arlington	90	43	65.5	0.00	
Ashland	93	35	61.0	0.67	
Aurora *1	90	50	62.6	0.57	
Aurora (near)	89	39	59.4	1.07	
Bay City	90	36	55.0	3.83	
Bend	90	22	52.4	T.	
Beulah	102	34	64.4	0.00	
Blackbutte	89	40	61.3	0.90	
Blalock	96	43	70.0	T.	
Brownsville *1	90	50	63.4	0.07	
Bullrun				2.22	
Cascade Locks	84	40	60.8	1.49	
Comstock *1	91	45	58.5	0.00	
Coquille				0.53	
Corvallis	98	40	60.6	0.27	
Dayville	91	37	59.6	0.44	
Detroit	94	36	59.0	1.05	
Doraville	85	38	57.4	1.00	
Ella				T.	
Eugene	88	41	59.7	0.32	
Fairview	82	35	56.7	0.97	
Falls City	87	37	57.0	1.11	
Gardiner	65	40	52.0	2.07	
Glenora	86	35	56.8	2.76	
Government Camp	76	30	47.8	1.54	
Grants Pass	93	35	62.2	0.12	
Hare	75	40	55.4	1.67	
Heppner	91	37	61.3	0.47	
Hood River (near)	88	38	60.4	0.30	
Huntington	99	34	69.0	0.42	
Jacksonville	92	35	62.6	0.15	
Joseph	86	27	52.8	0.41	
Junction City *1	98	48	62.6	0.25	
Kerby	95	36	61.9	0.30	
Klamath Falls	91	28	60.7	0.00	
Lafayette *1	92	51	63.4	0.57	
Lagrande	92	32	62.0	0.83	
Lakeview	92	34	61.5	0.10	
Lonerock	86	33	55.8	0.28	
McKenzie Bridge	95	31	58.9	0.94	
McMinnville	88	36	59.4	0.68	
Merlin *1	94	44	64.8	0.23	
Monmouth *a* *1	89	43	59.2	0.61	
Monroe	89	40	59.1	0.71	
Mount Angel	91	44	60.2	0.90	
Nehalem				3.39	
Newberg	89	38	59.2	0.70	
Newport	80	42	55.5	1.92	
Pendleton	96	36	64.6	0.34	
Pine	94	26	58.4	1.00	
Placer				0.41	
Prineville	87	35	58.8	0.08	
Riddles *1	97	40	62.4	0.20	
Salem	91	44	60.9	0.90	
Sheridan *1	90	45	61.7	0.32	
Silverlake	90	22	54.8	T.	
Silverton *1	94	54	66.4	1.63	
Siskiyou *1	88	35	62.2	0.00	
Sparta	90	31	58.8	1.20	
Stafford	84	39	59.1	1.13	
The Dalles	92	40	65.9	0.13	
Toledo	84	39	58.3	1.95	
Umatilla	94	41	68.0	0.00	
Vale	96	35	62.2	0.75	
Wamic	95	30	59.4	0.05	
Warm Spring	92	36	61.6	0.04	
Westfork *1	96	42	59.8	0.00	
Weston	89	30	58.6	0.16	
Williams	90	35	61.2	0.20	
Pennsylvania.					
Aleppo	91	38	66.2	3.67	
Altoona	91	44	67.7	4.95	
Aqueduct	90	35	63.2	5.18	
Beaver Dam				5.74	
Bellefonte	88	39	67.2	6.47	
Brookville				6.80	
California	93	34	66.8	3.89	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Pennsylvania—Cont'd.					
Cassandra	89	35	62.7	5.72	
Clarion				6.14	
Coatesville	96	45	69.3	6.40	
Confluence				4.08	
Davis Island Dam				5.16	
Derry Station	91	36	66.5	6.25	
Doylestown				6.13	
Drifton					
Driftwood				6.18	
Duncannon				5.51	
Dushore	87	34	62.0	7.39	
East Bloomsburg				6.60	
East Mauch Chunk	94	40	66.4	8.93	
Easton	90	46	68.6	6.50	
Ellwood Junction				5.67	
Emporium	88	38	63.7	7.15	
Ephrata	94	45	68.2	5.82	
Everett	94	36	64.8	6.24	
Forks of Neshaminy				6.89	
Franklin	88	33	63.1	6.46	
Freeport				5.22	
Girardville				7.76	
Greensboro				5.48	
Hamlinton	88	38	62.2	6.60	
Hawthorn	90	35	64.3	7.52	
Herrs Island Dam				5.06	
Huntingdon *a*				5.78	
Huntingdon *b*	93	36	66.6	7.18	
Irwin	92	34	66.5	6.80	
Johnstown	95	38	68.2	6.73	
Keating				5.48	
Kennett Square	90	47	68.6	5.91	
Lancaster	86	39	71.1		
Lansdale				3.59	
Lawrenceville	90	33	62.5	5.54	
Lebanon	96	41	68.6	6.18	
Leroy	88	37	62.2	5.40	
Lewisburg	92	39	66.4	8.28	
Lockhaven *a*	92	41	68.0	6.12	
Lockhaven *b*				5.59	
Lock No. 4				3.35	
Lycippus	90	43	66.6	6.09	
Mifflin				6.60	
Oil City				7.24	
Ottsville				5.72	
Parker				6.14	
Philadelphia	94	52	71.4	6.52	
Pocono Lake	84	33	61.0	6.25	
Point Pleasant				5.07	
Pottsville				7.12	
Quakertown	93	42	67.6	5.15	
Reading			68.2	5.29	
Renovo *a*				4.71	
Saegerstown	86	34	62.2	6.11	
St. Marys	85	36	61.2	6.56	
Saltsburg				4.94	
Seisholtzville				6.54	
Selinsgrove	90	41	66.8	8.11	
Shawmont				5.10	
Smiths Corners				5.03	
Somerset	87	34	61.6	4.45	
South Eaton	88	39	64.6	6.61	
Spring Mount				4.74	
State College	86	41	64.2	6.71	T.
Sunbury				6.93	
Swarthmore	92	50	70.5	5.89	
Towanda	89	37	63.8	4.86	
Troutrun				6.68	
Uniontown	88	44	68.7	5.95	
Warren	87	35	62.4	5.79	
Wellsboro	87	32	62.1	6.17	
Westchester	93	49	69.4	6.75	
West Newton				4.52	
Westtown	92	47	70.0		
Wilkesbarre	92	40	66.4	6.10	
Williamsport	88	46	67.2	5.61	
York	97	42	70.0	5.15	
Rhode Island.					
Bristol	79	52	63.4	3.44	
Kingston	88	40	62.6	4.15	
Pawtucket	89	51	66.6	4.75	
Providence *a*	93	51	67.8	4.17	
Providence *c*	91	47	64.6	4.70	
South Carolina.					
Aiken	101	59	81.3	3.70	
Allendale	98	63	79.8	7.35	
Anderson	101	60	79.0	3.64	
Barksdale	100	58	80.0	5.70	
Batesburg	99	59	77.8	6.38	
Beaufort	98	65	79.9	2.16	
Blackville	99	59	79.6	6.91	
Bowman	98	59	78.8	8.02	
Calhoun Falls				4.25	
Camden				5.46	
Cheraw *a*	98	56	77.1	1.39	
Cheraw *b*				1.42	
Clemson College	100	56	77.2	4.28	
Conway	100	57	77.1	4.20	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Darlington	100	55	79.3	2.62	
Duewest	......	66	......	4.07	
Edisto				7.53	
Effingham				6.08	
Florence	98	59	79.8	2.82	
Gaffney	103	54	78.2	7.11	
Georgetown	99	63	80.7	4.00	
Gillisonville	103	60	79.3	4.02	
Greenville	96	54	73.5	5.34	
Greenwood	101	57	78.5	5.38	
Heath Springs	100	55	77.4	3.77	
Kingstree *a*	98	62	76.5	4.20	
Kingstree *b*				4.18	
Liberty	105	56	78.7	3.01	
Little Mountain	101	59	79.2	4.82	
Longshore	100	58	78.8	5.47	
Lugoff	100	55	78.5	4.22	
Pinopolis *[1]	96	60	79.2	4.70	
St. Georges	96	62	78.2	5.40	
St. Matthews	94	62	77.7	3.76	
St. Stephens				5.05	
Saluda	100	58	79.4	4.83	
Santuck	100	52	77.3	3.61	
Seivern	100	53	78.1	7.22	
Smiths Mills				4.00	
Society Hill	99	59	79.1	2.28	
Spartanburg	100	55	76.6	6.43	
Statesburg	98	59	78.8	4.67	
Summerville	99	58	77.2	2.81	
Sumter	103	58	77.8	3.24	
Temperance	99	55	78.0	3.54	
Trenton	97	60	79.0	8.11	
Trial	98	59	77.4	4.52	
Walhalla	98	54	74.7	2.47	
Winnsboro	99	57	77.9	6.78	
Winthrop College	97	54	77.2	4.98	
Yemassee	100	64	80.2	2.61	
Yorkville	102	58	79.3	5.33	
South Dakota.					
Aberdeen	94	31	61.4	3.92	
Academy	96	36	64.4	2.50	
Alexandria	91	32	63.0	3.86	
Armour	96	30	63.4	1.38	
Ashcroft	93	24	60.4	2.41	
Bad Nation [4]	111	29	68.0	1.38	
Bowdle	97	30	59.1	4.26	
Brookings	87	30	60.2	3.17	
Canton	93	30	65.2	2.97	
Centerville				1.68	
Chamberlain	99	34	64.7	2.28	
Clark	89	31	60.4	3.73	
Desmet	86	34	61.4	3.83	
Doland	90	30	62.2	4.16	
Elkpoint	102	37	68.0	2.86	
Farmingdale				3.13	
Faulkton	95	32	60.2	4.39	
Flandreau	89	31	60.8	1.36	
Forestburg	93	31	62.6	3.44	
Fort Meade	......	39	......	3.57	
Fort Randall	95[j]	34[j]	63.1[j]	1.31	
Gannvalley	99	32	63.9	4.54	
Grand River School	100	31	61.4	2.32	
Greenwood	96	38	67.6	1.69	
Hitchcock				3.12	
Hotch City	103	29	64.0	1.95	
Howard	85	25	59.0	6.87	
Howell	96	30	60.8	5.51	
Ipswich	98[h]	29[e]	62.3[h]	2.95	
Kimball	93	35	63.2	2.39	
Leola	100	27	59.1	2.55	
Leslie	99	30	64.0	3.27	
Marion	90	31	63.2	2.36	
Mellette	93	30	61.6	2.34	
Menno	92	32	64.2	2.37	
Millbank	90	35	61.4	2.63	
Mitchell	93	33	64.0	......	
Oelrichs	101	35	63.6	5.30	
Pedro	95	31	63.4	10.31	
Pine Ridge	100	34	63.8	4.68	
Plankinton	96	33	64.2	3.73	
Ramsey	90	25	62.6	2.11	
Redfield	94	30	60.3	2.85	
Rochford	91	23	55.4	2.69	
Rosebud	103	33	65.5	2.51	
St. Lawrence	97[h]	28[g]	59.2[h]	6.24	
Silver City				2.87	
Sioux Falls	90	34	63.4	2.98	
Sisseton Agency	84	36	59.9	2.48	
Spearfish	90	34	60.0	1.08	
Tyndall	94	35	66.2	1.81	
Vermilion	96	39	66.6	2.76	
Watertown	86	31	60.2	......	
Waubay	87	30	59.2	1.70	
Wentworth	88	32	61.6	1.45	
Wessington Springs	95	39	64.2	......	
Wolsey	......	......	......	3.39	
Tennessee.					
Andersonville	96	47	72.6	4.33	
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Arlington	100	52	77.9	8.99	
Ashwood	99	47	76.2	3.20	
Beaverhill	94	44	71.4	5.90	
Benton	100	47	76.4	5.14	
Bluff City				8.02	
Bolivar	99	51	76.4	4.25	
Bristol	94	40	68.6	7.72	
Brownsville	96	50	76.2	3.25	
Byrdstown	95	47	73.4	6.26	
Carthage	98	50	76.6	4.51	
Charleston				6.23	
Clarksville	96[g]	53[g]	76.6[g]	2.95	
Clinton				5.46	
Covington	95	53	77.0	7.38	
Decatur	99	48	75.2	2.50	
Dickson	98	47	76.4	2.25	
Dover *	98	44	75.0	3.27	
Dyersburg	100	52	78.0	3.97	
Elizabethton	94	46	69.6	8.19	
Erasmus	95	38	69.5	8.23	
Florence	96	48	75.8	2.16	
Franklin	96	49	76.0	1.54	
Grace *[1]	102	50	77.8	7.70	
Greeneville	93	46	71.4	8.62	
Harriman	96	49	74.6	6.31	
Hohenwald	98	42	73.9	4.40	
Iron City	99	46	76.2	2.12	
Isabella	94	53	74.8	3.52	
Johnsonville	97	46	75.8	4.24	
Kenton *[5]	98	48	76.8	2.58	
Kingston	......	......	......	5.70	
Lafayette *[5]	95	52	74.0	2.20	
Leadvale	......	......	......	5.28	
Lewisburg	99	47	77.4	1.60	
Liberty	97	45	74.4	5.57	
Lynnville	97	50	77.4	1.91	
McKenzie	101	56	78.2	2.43	
McMinnville	102	45	75.4	4.21	
Maryville	103	49	76.0	4.36	
Milan	100	50	77.8	3.78	
Newport	93	52	74.3	5.40	
Nunnelly	98	43	74.8	1.84	
Palmetto	99	49	77.3	3.05	
Pope	99	42	76.6	2.04	
Rogersville	93	47	71.9	6.20	
Rugby	95	40	70.5	5.13	
Savannah	98	51	77.7	4.08	
Sewanee	95	51	74.4	3.16	
Silverlake	87	41	65.8	10.08	
Sinking Spring	......	......	......	4.84	
Springdale	96	45	71.3	7.95	
Springfield	100	45	75.2	3.93	
Tazewell	......	......	......	7.97	
Tellico Plains	98	48	74.8	5.02	
Tracy City	98	38	73.7	1.84	
Tullahoma	96	45	73.6	2.25	
Waynesboro	98	42	75.5	2.27	
Wildersville	93	......	......	3.36	
Texas.					
Albany	100	60	81.4	1.61	
Alvin	......	......	......	8.32	
Anna	105	54	83.5	1.06	
Anson	......	......	......	0.20	
Arthur	......	......	......	3.95	
Austin *a*	100	68	85.0	0.60	
Austin *b* *[5]	98	64	81.7	......	
Ballinger	105	55	82.2	2.20	
Bastrop	103	67	85.0	0.66	
Beaumont	106	64	86.0	1.23	
Beeville	102	65	84.1	0.70	
Bigspring	110	57	82.9	1.41	
Blanco	98	64	80.8	0.01	
Boerne *[1]	106	68	83.0	0.39	
Booth	......	......	......	7.29	
Bowie	109	54	83.6	0.12	
Brazoria	93	65	79.9	7.60	
Brenham	99	66	83.3	2.53	
Brighton	91	70	83.2	1.23	
Brownwood	103	63	83.4	1.24	
Burnet	100	62	80.3	2.17	
Camp Eagle Pass	109	70	84.0	0.00	
Childress	109	49	80.3	0.62	
Coleman	......	......	......	3.08	
College Station	97	68	86.5	1.40	
Colorado	113	53	85.0	0.95	
Columbia	96	65	80.8	4.23	
Comanche	104[f]	62[f]	82.2[f]	0.83	
Corsicana	104	59	83.6	2.35	
Cotulla	116	73	91.4	0.00	
Cuero	101	67	84.6	5.86	
Dallas	105	56	83.8	1.16	
Danevang	100	63	82.2	5.27	
Dublin	104	62	81.6	1.01	
Duval	99	66	83.4	0.64	
Estelle	106	56	84.8	1.03	
Fort Brown	97	70	83.4	0.60	
Fort Clark	107	62	80.6	0.00	
Fort Davis	101	54	79.8	2.63	
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort McIntosh	111	64	88.9	0.10	
Fort Ringgold	109	72	88.4	0.00	
Fredericksburg	104	63	83.7	0.06	
Gainesville	106[h]	53[f]	83.2[g]	0.27	
Georgetown	100	63	84.0	1.13	
Grapevine	106	55	82.8	0.70	
Greenville	104	54	83.4	1.84	
Hale Center	108	55	78.3	T.	
Hallettsville	100	64	83.2	4.11	
Haskell	113	53	84.4	1.95	
Hearne	102	61	82.6	2.60	
Henrietta	112	54	83.2	0.90	
Hewitt	......	......	......	1.90	
Hondo	102	68	......	0.00	
Houston	101	61	83.7	5.01	
Huntsville	99	61	82.9	3.37	
Ira	110	54	82.4	1.21	
Jacksonville	97	60	80.5	1.42	
Jasper	97	58	80.5	1.95	
Kaufman	107	66	86.2	2.12	
Kent	......	......	......	0.50	
Kerrville	102	58	80.4	0.00	
Kopperl	......	......	......	2.30	
Lampasas	101	60	82.4	1.81	
Lapara	......	......	......	0.23	
Laureles Ranch	......	......	......	0.86	
Llano *[1]	105	69	85.1	0.80	
Longview	102	58	83.2	4.50	
Luling	101	65	82.6	1.65	
Mann	103	58	83.4	3.20	
Menardville	106	57	80.6	0.75	
Mount Blanco	110	48	80.0	0.01	
Nacogdoches	98	55	79.9	14.22	
New Braunfels	98	66	84.2	0.22	
Panter	105[g]	60[g]	84.7[g]	0.55	
Paris *a*	102	46	80.0	1.97	
Pearsall	110	70	86.4	0.00	
Port Lavaca	95	70	83.4	3.50	
Rhineland	114	51	83.6	0.44	
Rockisland	99	64	81.4	5.85	
Rockport	87	68	77.2	1.51	
Runge	102	69	85.4	1.31	
Sanderson	105	60	83.4	0.00	
San Marcos	100	61	83.1	0.72	
San Saba	106	64	83.2	0.82	
Santa Gertrude Ranch	......	......	......	0.15	
Shaeffer Ranch	107	69	86.0	1.11	
Sherman	99	57	82.8	0.89	
Sugarland	97	58	81.0	4.11	
Sulphur Springs	100[d]	55[d]	81.8[d]	1.70	
Temple *a*	100	65	83.0	1.91	
Temple *b*	102	63	82.6	1.78	
Trinity	102	61	83.0	3.24	
Tulia	109	43	74.3	0.87	
Tyler	104	60	83.2	4.50	
Victoria	100[d]	66[d]	82.5[d]	2.03	
Waco	104	65	86.3	3.15	
Waxahachie	105	59	82.8	2.25	
Weatherford	104	57	84.0	0.62	
Weimar	102	67	84.6	3.90	
Wharton	97	67	82.8	7.12	
Utah.					
Alpine	......	......	......	0.38	
Aneth	104	38	74.8	0.00	
Blackrock	94	31	66.0	T.	
Castledale	101	29	66.9	T.	
Corinne	101	31	68.4	T.	
Coyoto	89[d]	29[d]	63.4[d]	0.26	
Deseret	99	31[d]	68.2[b]	T.	
Emery	85	30	59.9	0.00	
Escalante	97	38	70.2	T.	
Farmington	98	34	66.9	0.17	
Fillmore	104	34	71.8	0.09	
Fort Duchesne	98	35	68.7	0.50	
Frisco	96[g]	47[g]	73.1[g]	T.	
Giles	104	35	71.8	0.14	
Government Creek	97	32	66.8	0.07	
Green River	108	38	76.9	0.09	
Grover	93	34	66.9	T.	
Heber	95	28	61.2	0.37	
Henefer	92	27	60.0	0.43	
Hite	109	50	81.0	0.00	
Huntsville	......	......	......	0.89	
Kelton *[1]	100	42	66.0	0.00	
La Sal	94	25	65.2	0.03	
Levan	93	34	66.2	0.03	
Loa	90	21	57.8	0.00	
Logan	91	35	65.4	0.74	
Manti	94	32	65.2	0.04	
Marysvale	95	31	64.8	0.19	
Meadowville	90	30	59.2	0.90	
Millville	......	......	......	0.31	
Moab	104	38	73.8	0.43	
Monticello	94	36	68.0	0.35	
Mount Nebo	100	37	70.0	T.	
Mount Pleasant	95	31	66.8	0.09	
Ogden	92	38	67.6	0.27	
Parowan	95	31	66.8	0.06	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pinto	89	24	60.6	T.	
Plateau	90	23	60.4	0.31	
Promontory				0.00	
Provo	102	32	67.8	0.10	
Ranch	90	30	59.2	T.	
Richfield	93	31	64.2	0.24	
St. George	114	36	75.1	0.03	
Scipio	101	29	67.1	0.08	
Snowville	94	24	61.6	0.34	
Soldier Summit	86	24	55.2	0.00	
Terrace	100	29	67.9	0.20	
Thistle	105	43	70.8	0.00	
Tooele	96	39	67.9	0.10	
Tropic	93	27	62.7	0.00	
Vernal	97	34	69.0	0.51	
Virgin	103	40	79.0	0.00	
Wellington	97	33	66.6	0.00	
Woodruff	91	23	57.6	0.18	
Vermont.					
Burlington	81	44	63.2	5.29	
Chelsea	82	37	58.2	4.03	
Cornwall	81	39	61.6	3.61	
Enosburg Falls	84	32	59.6	5.64	
Hartland	84	35	59.6	4.13	
Jacksonville	82	35	57.4	3.34	
Manchester	82	36	60.6	3.70	
Newport	86	35	59.9	8.51	
Norwich	84	34	58.3	3.47	
St. Johnsbury	85	33	59.6	4.45	
Vernon *[6]	85	54	64.9	3.46	
Wells	84	36	59.8	4.09	
Woodstock	86	34	60.5	3.55	
Virginia.					
Alexandria	95	48	72.9	3.99	
Ashland	96	49	73.0	5.07	
Bedford	102	46	73.6	4.58	
Bigstone Gap	94	45	70.2	7.15	
Birdsnest [2]			70.6	1.25	
Blacksburg	94	38	68.4	2.90	
Bonair	96	49	73.0	4.32	
Buckingham	101[1]	40[1]	67.9[1]	5.67	
Burkes Garden	85	34	62.9	6.77	
Callaville	95	49	74.2	2.80	
Charlottesville	96	50	71.9	5.09	
Clarksville				2.55	
Cliftonforge	98	37	67.8	1.15	
Columbia	98	45	72.7	2.45	
Dale Enterprise	96	41	68.0	2.90	
Danville				3.95	
Farmville	100	47	74.7	5.55	
Fredericksburg	99	52	73.6	5.78	
Freeling	84	44	67.0	6.85	
Grahams Forge [j]	85	40	66.1	2.85	
Hampton	92	59	75.2	1.70	
Hot Springs	93	36	68.4	5.46	
Lexington	93	42	69.4	2.91	
Lincoln	100	45	73.2	2.49	
Manassas	95	45	71.1	2.23	
Marion	91	40	67.2	6.80	
Mendota				7.45	
Newport News	100	60	78.0	1.20	
Petersburg	98	51	72.7	3.47	
Quantico	96	44	72.8		
Radford				3.23	
Riverton				2.70	
Roanoke	95	42	70.7	3.95	
Rockymount	87	47	66.8	5.38	
Salem				4.68	
Shenandoah				2.37	
Speers Ferry				7.34	
Spottsville	95	46	73.9	2.96	
Stanardsville	100	36	67.4	3.15	
Staunton	94	41	69.4	3.08	
Warsaw	97	47	73.5	5.74	
Westpoint	94	50	75.0	3.14	
Wilkersons	99	48	73.2	5.60	
Williamsburg	90	52	71.8	2.49	
Woodstock	98	42	69.2	3.60	
Wytheville	93	41	68.1	4.98	
Washington.					
Aberdeen	86	38	56.6	3.06	
Anacortes				0.59	
Ashford				3.11	
Bremerton	85	39	59.4	1.34	
Brinnon	84	41	59.9	1.73	
Cedonia	83	30	56.0	1.68	
Centralia	91	35	57.4	2.07	
Cheney				T.	
Clearwater	75	42	56.2	5.17	
Cle Elum	91	30	56.8	0.04	
Colfax	87	32	56.6	0.29	
Colville	89	29	56.8	1.21	
Conconully	84	32	58.3	0.94	
Connell				0.00	
Coupeville	85	42	57.4	0.78	
Crescent	87	30	57.0	0.24	
Dayton	87	38	61.8	0.07	
East Sound	82	33	55.8	0.39	

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ellensburg	87	34	58.5	0.05	
Ellensburg (near)	90	34	60.8	0.02	
Grandmound	86	33	57.6	1.17	
Granite Falls				3.49	
Hooper	94	33	63.5	T.	
Ilwaco	91	42	58.8	2.23	
Lacenter	87	38	59.4	0.82	
Lakeside	88	40	63.5	T.	
Lind	97	35	65.7	0.07	
Loomis	90	38	63.6	0.65	
Mayfield [c]	89	34	59.2	2.76	
Mottinger Ranch	98	41	67.6	0.03	
Mount Pleasant	83	40	59.2	1.43	
Moxee Valley	91	31	61.7	0.06	
Olga	78	45	58.2	0.55	
Olympia	87	36	58.9	0.74	
Pasco	101	50	71.0	0.00	
Pinehill	91	36	62.0	0.12	
Pomeroy	96	34	62.8	0.45	
Port Townsend	84	44	57.8	9.93	
Pullman	87	36	58.2	0.04	
Rattlesnake Mountains				0.10	
Republic	89	27	56.6	1.01	
Ritzville				0.00	
Ritzville (near)				0.01	
Rosalia	85	30	56.8	0.22	
Sedro	88	35	58.8	0.80	
Silvana	86	36	57.4	1.55	
Snohomish	83	41	59.2	1.65	
Snoqualmie	86	39	59.9	1.77	
Southbend	91	39	57.4	2.98	
Sprague				0.00	
Stampede				1.10	
Sunnyside	91	37	63.4	9.11	
Union	84	40	58.7	2.30	
Usk	85	36	58.4	1.13	
Vancouver	88	40	59.6	0.75	
Vashon	85	42	58.6	1.56	
Waterville	90	31	58.1	0.13	
Wenatchee (near)	87	34	60.8	0.05	
Whatcom	87	35	57.2	0.72	
Wilbur	87	28	55.3	0.25	
Zindel	99	45[k]	66.8[f]	1.11	
West Virginia.					
Addison	96	41	67.4	5.90	
Bayard	86	36	62.3	3.75	
Beckley	86	36	68.2	2.88	
Beverly	90	38	64.8	4.72	
Bluefield	90	40	67.3	6.20	
Burlington	93	38	67.6	4.71	
Byrne	97	42	71.7	6.20	
Cairo	98	41	68.8	4.00	
Camden	87	50	62.5	3.57	
Central	94	39	66.7	6.99	
Chapel	95	48	71.4	5.21	
Charleston	98	48	67.3	6.35	
Creston	97	45	71.6	4.00	
Cuba	91	44	68.6	4.66	
Dayton	93	36	66.0	6.55	
Echo	97	45	71.6	6.04	
Elkhorn	91	42	68.2	5.63	
Fairmont				4.30	
Glenville	93	44	68.2	5.35	
Grafton	92	38	65.8	5.68	
Green Sulphur	87	40	66.4	3.68	
Harpers Ferry				2.00	
Hinton *a*				4.25	
Huntington	96	48	71.3	5.60	
Josiah	96	44	68.4	6.52	
Leonard	86	41	62.8	5.52	
Lewisburg	92	37	65.4	4.33	
Logan	100	48	72.6	6.40	
Magnolia	98	35	67.2	3.09	
Martinsburg	98	45	69.4	3.22	
Morgantown	91	40	67.8	7.16	
Moscow	88	42	64.9	7.08	
Moundsville	92	43	67.6	3.88	
New Martinsville	99	44	70.4	5.59	
Nuttallburg	94	40	69.0	6.37	
Oldfields	98	36	67.0	3.31	
Parsons	93	34	64.4	3.00	
Philippi	92	37	66.8	7.06	
Pickens	89	36	63.6	6.38	
Point Pleasant	96	49	71.2	6.59	
Powellton	96	44	69.6	8.49	
Princeton	88	41	66.4	4.90	
Rippon	99	41	72.1	2.45	
Romney	97	41	69.2	3.89	
Rowlesburg				5.27	
Southside	94	50	71.4	5.24	
Terra Alta	87	33	62.0	7.40	
Uppertract	96	34	66.8	3.81	
Wellsburg	88	42	65.4	6.88	
Weston *a*				5.17	
Weston *b*	96	42	71.8		
Wheeling *a*				4.47	
Wheeling *b*	96	51	72.4	7.45	
Williamson	95	49	70.8	5.72	

Stations.	Temperature. (Fahrenheit.) Maximum.	Temperature. (Fahrenheit.) Minimum.	Temperature. (Fahrenheit.) Mean.	Precipitation. Rain and melted snow.	Precipitation. Total depth of snow.
Wisconsin.	°	°	°	*Ins.*	*Ins.*
Amherst	80	36	59.8	3.65	
Appleton	83	40	61.2	3.27	
Ashland				2.79	
Barron	80	36	59.7	4.39	
Beloit	85	42	65.0	6.57	
Brodhead	87	42	64.6	5.90	
Butternut	80	29	57.3	8.37	
Chilton	83	37	59.8	3.44	
Darlington	86	36	63.1	8.50	
Delvan	85	42	63.5	5.02	
Dodgeville	84	40	63.1	5.07	
Easton	83	36	64.0	2.59	
Eau Claire	85	41	64.4	2.27	
Florence	81	32	57.6	3.56	
Fond du Lac	83	41	63.0	4.72	
Grand River Locks				4.13	
Grantsburg	84	35	61.0	2.98	
Harvey	84	41	63.7	4.35	
Hayward	81	32	58.4	5.03	
Hillsboro	83	36	61.6	3.17	
Koepenick	94	29	60.4	4.30	
Ladysmith	83	35	59.9	3.20	
Lancaster	84	39	63.0	5.50	
Madison	85	46	63.2	4.27	
Manitowoc	88	39	59.8	3.81	
Meadow Valley	82	36	61.4	2.35	
Medford	92	35	62.7	2.80	
Menasha				3.88	
Neillsville	90	38	63.2	3.58	
New London	85	39	62.0	4.09	
Oconto	85	38	61.6	3.71	
Osceola	84	34	61.2	3.02	
Oshkosh	84[d]	41[e]	65.1[e]	3.00	
Pepin	86	46	65.0	3.95	
Pine River	85	39	61.7	4.24	
Portage	84	44	64.2	3.06	
Port Washington	89	36	59.4	3.65	
Prairie du Chien *a*	88	41	65.8	6.57	
Prairie du Chien *b*				6.58	
Prentice	81	31	58.2	6.11	
Racine	87	44	62.6	5.46	
Sheboygan	85	43	60.8	3.19	
Spooner	87	32	59.6	3.64	
Stevens Point	82	35	61.4	3.16	
Viroqua	88	38	61.1	3.54	
Watertown	84	39	62.5	4.04	
Waukesha	83	42	61.8	4.53	
Waupaca	83	38	62.2	3.75	
Wausau	81	34	61.0	3.12	
Wausaukee	84	32	61.3	1.54	
Westfield	84	42	63.7	3.71	
Whitehall	85	36	62.9	2.77	
Wyoming.					
Alcova	98	36	65.8	0.90	
Basin	103	40	67.1	0.24	
Bedford	89	25	55.8	0.95	
Border	88	26	56.4	0.46	
Buffalo	92	31	59.0	2.46	
Carbon	93	31	63.2	1.45	
Centennial	87	25	59.0	0.60	
Chugwater	93	32	61.3	4.43	
Daniel	81	19	51.0	0.22	
Evanston	85	26	55.2	0.76	
Fort Laramie	102	39	65.6	3.80	
Fort Washakie	91	31	62.5	0.54	
Fort Yellowstone	84	30	54.0	1.97	
Fourbear	82	28	51.8	1.12	
Gillett	94	35	61.6	0.74	
Griggs	94	30	60.6	1.90	
Hyattville	96	34	63.2	1.20	
Irma	91	32	59.6	1.22	
Iron Mountain	92	31	61.0	2.29	
Laramie *[3]	87	28	57.9	0.60	
Leo	87	28	57.0	0.50	
Lusk	97	30	60.4	3.05	
Moore	93	30	60.6	2.66	
Parkman	84	30	57.2	0.95	
Pinebluff	101	33	64.7	0.39	
Rawlins	93	31	61.6	1.10	
Red Bank	98	33	61.8	2.21	
Rocksprings	94	31	65.0	0.80	
Saratoga	91	30	61.2	0.88	
South Pass City	83	20	51.2	0.30	
Thayne	86	26	56.5	1.13	
Thermopolis	100	36	64.6	1.42	
Porto Rico.					
Adjuntas	88	55	73.3	13.61	
Aguadilla	97	68	82.8	17.60	
Aguirre	90	70	79.8	22.75	
Arecibo	95	68	80.5	4.60	
Barros	89	56	76.2	13.23	
Bayamon	96	69	80.4	16.99	
Caguas	91	64	77.2	22.15	
Canovanas	95	72	81.2	13.87	
Cayey	97	63	78.4	28.11	
Cidra	89	60	74.8	30.98	
Coamo	92	60	78.2	15.80	
Corozal[1]	92	66	78.6	12.50	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Experimental Station	......	......	......	12.33	
Fajardo	93	70	80.6	16.29	
Guanica	92	......	......	13.25	
Guayama	......	......	......	24.75	
Hacienda Amisted	90	62	77.2	7.19	
Hacienda Coloso	92	65	78.6	9.20	
Hacienda Perla	90	71	78.4	32.92	
Humacao	90	74	81.9	19.47	
Isabela	89	69	79.1	9.95	
Juana Diaz	91	70	80.4	17.69	
La Isolina	92	65	77.9	8.94	
Las Marias	91	67	78.2	7.22	
Manati	94	68	80.0	8.18	
Maunabo	87	69	79.2	25.55	
Mayaguez	96	67	80.8	8.33	
Morovis	98	67	80.0	8.46	
Ponce	90	69	79.2	16.17	
San German	94	70	82.0	7.03	
San Lorenzo	91	68	78.5	29.11	
San Salvador	88	63	75.6	11.83	
Santa Isabel	91	70	79.7	16.54	
Utuado	96	66	79.4	10.62	
Vieques	90	76	83.4	14.45	
Yauco	89	69	79.4	15.45	
Mexico.					
Ciudad P. Diaz	104	74	88.8	0.00	
Coatzacoalcos	96	67	80.4	24.13	
Leon de Aldamas	94	53	73.7	2.44	
Vera Cruz	90	71	81.0	4.90	
New Brunswick.					
St. John	75	41	54.8	2.46	
Nicaragua.	°	°	°	*Ins.*	*Ins.*
Nandaime	89	75	81.9	33.77	
Isthmus of Panama.					
Alhajuela	92	74	80.8	......	
La Boca	90	75	81.5	5.43	

Late reports for May, 1902.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.					
Mushagak	65	23	40.2	1.29	
Tyoonok	65	29	45.0	0.38	
Arkansas.					
New Gascony	96	50	73.8	3.67	
California.					
Mills College	......	......	......	0.00	
Massachusetts.					
Lowell *b*	89	31	57.8	......	
Michigan.					
Ontonagon	83	29	31.6	1.97	T.
New Mexico.					
Las Vegas	81 h	33 h	58.3 h	1.95	
Las Vegas Hot Springs	80	33	58.4	3.06	0.1
Los Lunas	93	38	65.0	0.25	
New York.					
Adams Center	......	......	......	6.47	
Nicaragua.					
Nandaime	95	76	84.0	10.20	
Isthmus of Panama.					
La Boca	......	......	......	8.88	

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "n" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

February, 1902, Ohio, Marion, make total precipitation 0.95 instead of 0.90.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of June, 1902.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
	Hours.	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
New England.						
Eastport, Me	13	20	10	25	s. 65 w.	16
Portland, Me	12	26	9	28	s. 54 w.	23
Northfield, Vt	24	27	7	13	s. 65 w.	6
Boston, Mass	11	16	13	33	s. 76 w.	20
Nantucket, Mass	12	24	9	33	s. 63 w.	26
Block Island, R. I	11	24	7	34	s. 64 w.	30
New Haven, Conn	16	23	2	28	s. 75 w.	26
Middle Atlantic States.						
Albany, N. Y	15	23	9	22	s. 58 w.	15
Binghamton, N. Y.†	8	3	10	14	n. 39 w.	6
New York, N. Y	19	21	11	26	s. 82 w.	15
Harrisburg, Pa.†	3	4	9	16	s. 82 w.	7
Philadelphia, Pa	15	23	9	23	s. 60 w.	16
Scranton, Pa	26	14	11	22	n. 43 w.	16
Atlantic City, N. J	16	25	10	27	s. 62 w.	19
Baltimore, Md	17	22	7	25	s. 74 w.	19
Washington, D. C	19	23	11	20	s. 66 w.	9
Lynchburg, Va	16	23	10	30	s. 7 w.	21
Norfolk, Va	10	34	17	9	s. 18 w.	25
South Atlantic States.						
Richmond, Va	13	29	14	21	s. 24 w.	17
Charlotte, N. C	14	25	21	18	s. 15 e.	11
Hatteras, N. C	13	25	19	16	s. 14 e.	12
Kitty Hawk, N. C.†	5	15	10	8	s. 11 e.	10
Raleigh, N. C	16	23	13	22	s. 52 w.	11
Wilmington, N. C	9	23	23	18	s. 20 e.	14
Charleston, S. C	12	24	18	19	s. 5 w.	12
Columbia, S. C	10	26	24	15	s. 29 e.	18
Augusta, Ga	11	26	25	14	s. 36 e.	19
Savannah, Ga	5	27	17	24	s. 18 w.	23
Jacksonville, Fla	6	26	26	16	s. 27 e.	22
Florida Peninsula.						
Jupiter, Fla	4	20	32	12	s. 51 e.	25
Key West, Fla	7	14	42	4	s. 80 e.	38
Tampa, Fla	20	14	24	21	n. 18 e.	6
Eastern Gulf States.						
Atlanta, Ga	13	21	17	19	s. 14 w.	8
Macon, Ga.†	5	14	11	7	s. 24 e.	9
Pensacola, Fla.†	9	9	8	11	w.	3
Mobile, Ala	15	26	9	23	s. 52 w.	17
Montgomery, Ala	16	25	16	18	s. 13 w.	9
Meridian, Miss†	9	10	9	9	s.	1
Vicksburg, Miss	10	26	18	21	s. 11 w.	16
New Orleans, La	10	34	17	15	s. 5 e.	24
Western Gulf States.						
Shreveport, La	7	39	21	6	s. 25 e.	35
Fort Smith, Ark	10	22	31	2	s. 68 e.	31
Little Rock, Ark	14	33	14	12	s. 9 e.	19
Corpus Christi, Tex	2	37	37	2	s. 45 e.	49
Fort Worth, Tex	4	46	12	8	s. 5 e.	42
Galveston, Tex	4	41	27	3	s. 33 e.	44
Palestine, Tex	5	42	15	9	s. 9 e.	37
San Antonio, Tex	4	34	39	1	s. 52 e.	48
Taylor, Tex †	2	13	7	1	s. 29 e.	12
Ohio Valley and Tennessee.						
Chattanooga, Tenn	24	16	14	21	n. 41 w.	10
Knoxville, Tenn	28	16	12	20	n. 34 w.	14
Memphis, Tenn	18	25	16	19	s. 23 e.	7
Nashville, Tenn	22	19	15	19	n. 53 w.	5
Lexington, Ky. †	6	15	9	6	s. 18 e.	9
Louisville, Ky	18	22	12	17	s. 5[illegible] w.	6
Evansville, Ind.†	10	11	10	4	s. 80 e.	6
Indianapolis, Ind	22	22	10	20	w.	10
Cincinnati, Ohio	14	21	18	22	s. 30 w.	8
Columbus, Ohio	13	27	14	21	s. 27 w.	15
Pittsburg, Pa	22	17	10	29	n. 75 w.	19
Parkersburg, W. Va	14	27	11	20	s. 35 w.	15
Elkins, W. Va	17	14	4	34	n. 84 w.	30
Lower Lake Region.						
Buffalo, N. Y	9	22	9	33	s. 62 w.	27
Oswego, N. Y	6	17	10	33	s. 64 w.	25
Rochester, N. Y	13	19	12	35	s. 75 w.	23
Erie, Pa	16	13	9	31	n. 82 w.	22
Cleveland, Ohio	18	23	14	18	s. 39 w.	6
Sandusky, Ohio†	8	10	7	11	s. 63 w.	4
Toledo, Ohio	16	17	17	24	s. 45 w.	9
Detroit, Mich	18	15	17	24	n. 67 w.	7
Upper Lake Region.						
Alpena, Mich	19	18	15	21	n. 80 w.	6
Escanaba, Mich	19	23	11	17	s. 56 w.	7
Grand Haven, Mich	15	21	13	25	s. 63 w.	13
Houghton, Mich.†	7	4	11	14	n. 45 w.	4
Marquette, Mich	25	14	15	18	n. 15 w.	11
Port Huron, Mich	24	18	9	19	n. 59 w.	11
Sault Ste. Marie, Mich	17	10	18	29	n. 58 w.	13
Chicago, Ill	20	19	20	16	n. 76 e.	4
Milwaukee, Wis	21	16	17	20	n. 31 w.	5
Green Bay, Wis	14	24	16	21	s. 27 w.	11
Duluth, Minn	35	4	31	21	n. 18 e.	32
North Dakota.						
Moorhead, Minn	24	17	16	23	n. 45 w.	9
North Dakota.—Continued.						
Bismarck, N. Dak	21	19	20	11	n. 77 e.	9
Williston, N. Dak	26	14	18	14	n. 18 e.	12
Upper Mississippi Valley.						
St. Paul, Minn	17	24	11	25	s. 63 w.	15
La Crosse, Wis. †	12	12	4	8	w.	4
Davenport, Iowa	20	14	16	23	n. 49 w.	9
Des Moines, Iowa	16	22	19	14	s. 50 w.	7
Dubuque, Iowa	24	16	13	26	n. 58 w.	15
Keokuk, Iowa	22	22	15	18	w.	3
Cairo, Ill	14	32	11	14	s. 9 w.	18
Springfield, Ill	17	23	16	18	s. 18 w.	6
Hannibal, Mo. †	8	12	9	7	s. 27 e.	4
St. Louis, Mo	16	33	9	10	s. 3 w.	17
Missouri Valley.						
Columbia, Mo. *	10	12	10	6	s. 63 e.	4
Kansas City, Mo	20	25	19	7	s. 67 e.	13
Springfield, Mo	13	34	18	9	s. 54 e.	35
Lincoln, Nebr	22	24	0	4	s. 63 e.	4
Omaha, Nebr	24	20	25	5	n. 79 e.	20
Valentine, Nebr	20	21	19	11	s. 83 e.	8
Sioux City, Iowa †	13	9	12	5	n. 60 e.	8
Pierre, S. Dak	15	23	29	9	s. 68 e.	21
Huron, S. Dak	20	17	22	13	n. 72 e	9
Yankton, S. Dak. †	11	6	11	8	n. 31 e.	5
Northern Slope.						
Havre, Mont	19	13	20	24	n. 34 w.	7
Miles City, Mont	21	10	16	23	n. 32 w.	13
Helena, Mont	20	17	6	35	n. 84 w.	29
Kalispell, Mont	......	......	......	......	......	......
Rapid City, S. Dak	21	15	20	15	n. 40 e.	7
Cheyenne, Wyo	18	20	16	19	s. 56 w.	3
Lander, Wyo	17	16	8	31	n. 88 w.	23
North Platte, Nebr	11	26	27	9	s. 50 e.	33
Middle Slope.						
Denver, Colo	18	27	14	30	s. 61 w.	18
Pueblo, Colo	17	14	31	13	n. 81 w.	18
Concordia, Kans	17	27	20	6	s. 54 e.	17
Dodge, Kans	18	21	21	6	s. 79 e.	15
Wichita, Kans	15	34	20	2	s. 45 e.	26
Oklahoma, Okla	12	37	16	2	s. 29 e.	28
Southern Slope.						
Abilene, Texas	9	33	34	3	s. 52 e.	39
Amarillo, Tex	12	32	17	15	s. 6 e.	20
Southern Plateau.						
El Paso, Texas	19	11	19	27	n. 45 w.	11
Santa Fe, N. Mex	8	27	25	17	s. 23 e.	20
Flagstaff, Ariz	12	19	4	38	s. 78 w.	34
Phoenix, Ariz	13	8	26	24	n. 22 e.	5
Yuma, Ariz	10	25	12	24	s. 39 w.	19
Independence, Cal	24	16	13	24	n. 54 w.	13
Middle Plateau.						
Carson City, Nev	7	19	2	39	s. 72 w.	38
Winnemucca, Nev	20	16	11	32	n. 79 w.	21
Modena, Utah	4	23	4	41	s. 63 w.	41
Salt Lake City, Utah	29	11	21	13	n. 24 e.	19
Grand Junction, Colo	17	15	20	24	n. 63 w.	4
Northern Plateau.						
Baker City, Oreg	25	24	7	17	s. 84 e.	10
Boise, Idaho	19	20	11	27	s. 87 w.	16
Lewiston, Idaho †	2	4	24	1	s. 85 e.	23
Pocatello, Idaho	4	26	14	28	s. 32 w.	16
Spokane, Wash	10	26	21	16	s. 17 e.	16
Walla Walla, Wash	4	35	6	22	s. 27 w.	34
North Pacific Coast Region.						
Neah Bay, Wash	7	20	13	33	s. 57 w.	23
Port Crescent, Wash. *	0	4	5	24	s. 78 w.	19
Seattle, Wash	15	21	17	17	s.	6
Tacoma, Wash	26	17	5	25	n. 63 w.	22
Astoria, Oreg	16	19	6	37	s. 84 w.	31
Portland, Oreg	10	21	10	20	s. 42 w.	14
Roseburg, Oreg	39	4	12	17	n. 8 w.	3
Middle Pacific Coast Region.						
Eureka, Cal	30	14	6	21	n. 43 w.	21
Mount Tamalpais, Cal	34	1	1	42	n. 51 w.	52
Red Bluff, Cal	28	21	19	5	n. 63 e.	15
Sacramento, Cal	5	42	20	3	s. 24 e.	40
San Francisco, Cal	1	12	1	54	s. 78 w.	53
South Pacific Coast Region.						
Fresno, Cal	38	0	1	41	n. 46 w.	55
Los Angeles, Cal	4	19	10	35	s. 59 w.	29
San Diego, Cal	9	27	8	31	s. 52 w.	29
San Luis Obispo, Cal	16	15	1	31	n. 88 w.	30
West Indies.						
Bridgetown, Barbados	2	8	55	0	s. 84 e.	5
Cienfuegos, Cuba	24	12	37	3	n. 71 e.	36
Grand Turk	3	9	22	2	s. 73 e.	20
Havana, Cuba	9	9	47	2	e.	45
Puerto Principe, Cuba	17	9	44	4	n. 73 e.	41
San Juan, Porto Rico	1	24	46	4	s. 61 e.	47
Santiago de Cuba, Cuba	31	15	20	7	n. 39 e.	20

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, June, 1902.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.	1		3	1		2	3	6			1	1		1	3	5		9	1	4	3							3	1			48	17	T.
		A.																																0	0	A.
Arizona	56	T.							3	1	6	5	1											1					1	2	3	12		35	10	T.
		A.																																0	0	A.
Arkansas	57	T.	1		1		3		1										4	8	2	3				1			8	35	12	5		84	13	T.
		A.																																0	0	A.
California	167	T.									26	26																						52	2	T.
		A.																																0	0	A.
Colorado	81	T.			2	4	8	1		2	5	5	23	6	15	5	4	9	2	1	4	4				2	2	4	10	18	6	3		145	24	T.
		A.																																0	0	A.
Connecticut	21	T.			17	2			3	3					12	1	8	10		1			2		5			1						65	12	T.
		A.																												1				1	1	A.
Delaware	5	T.							2												1		1		1		2				3	2		12	7	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.							1						1						1		1				1	1				1		7	7	T.
		A.																																0	0	A.
Florida	47	T.	7	2		1	4		1	3	9	1	1	2	9	5	6	8	3	12	11	12	11	12	7	5	2	1	4	2	8	3		152	28	T.
		A.																																0	0	A.
Georgia	55	T.	1			5	1	2	12	18	1			1	1	3	3	6	3	10	3	7	9	3	1	1		2	1		1			95	23	T.
		A.																																0	0	A.
Idaho	34	T.	2				2		1					1	6		1		2	2					3	1		1	1	1	3			27	14	T.
		A.																																0	0	A.
Illinois	92	T.	27	12	24	17	4	37	20	4		11	30	15	30	16	23			9	1	2				2	30	19	34	20	19	8		414	24	T.
		A.																																0	0	A.
Indiana	58	T.	21	9	22	3	1	28	31	6		7	25	7	19	16	18	4	1	6	3	11	1	1	1	3	28	15	28	26	14	11		366	29	T.
		A.																																0	0	A.
Indian Territory	11	T.													1		2		1	1			2			1			1					9	7	T.
		A.																																0	0	A.
Iowa	149	T.	23	24	8	11	26	30	13		1	26	34	30	22	13	16	1	7	14	7	3		1	2	8	27	2	17	7				373	26	T.
		A.																																0	0	A.
Kansas	77	T.	1	9	15	20	9	22	14	5	1	1	3	15	9	11	16	3	7	29	21	17			5	1		1	6	17	26			284	26	T.
		A.																																0	0	A.
Kentucky	41	T.	4		8			2	10	7			9	3	3	5	7			10	1	4	1			1	10	16	18	14	7	7		147	21	T.
		A.																																0	0	A.
Louisiana	46	T.	4								4	3	6							2	13	6	10						2	2				52	10	T.
		A.																																0	0	A.
Maine	19	T.	1	6	4	1			1									4	2			1				3	3							26	10	T.
		A.																																0	0	A.
Maryland	48	T.	1	2	5	2			12	1			7	5	18	3	2	4		3	11	2	12		2		17	5		1	10	12		137	22	T.
		A.																																0	0	A.
Massachusetts	48	T.	1		10									1	10	1	2	7									1							33	8	T.
		A.																																0	0	A.
Michigan	106	T.	12	33	15			18	8		9	2	4	25	10	23	24	4		3	1	1	2	1	5	4	11							214	21	T.
		A.																																0	0	A.
Minnesota	67	T.	6	20	2		12	4	3		10	6	3	4	1	19	2		6	2		2	1		1	9	10				1	1		125	22	T.
		A.																																0	0	A.
Mississippi	44	T.	5				2	1		1	1	1	2	1				1	6	13	10	10	6						5	9	1			75	17	T.
		A.																																0	0	A.
Missouri	95	T.	14	11	32	34	14	38	30	14		3	9	7	26	3	33	1	8	14	24	33	1	1		2	5	9	28	23	30	7		454	28	T.
		A.																																0	0	A.
Montana	40	T.	7	2	4	5	1	2	1	1	1	3	2	1	2	2	2	4	4	5	1	1				5	5	3	3	3	5	8		83	27	T.
		A.										1																						1	1	A.
Nebraska	142	T.	3	3	2	5	26	20	23		1	3	11	16	14	18	7	6	17	18	18	2	3		23	5	5	4	33	5	8	13		312	28	T.
		A.																																0	0	A.
Nevada	40	T.										1	5	4																				10	3	T.
		A.																																0	0	A.
New Hampshire	19	T.		5	6	2				1		1		1	4			13											1					34	9	T.
		A.																																0	0	A.
New Jersey	51	T.			11				14	1			2		16	11		10		1	15		20		10	8	12	5		1	3	1		141	17	T.
		A.																												1				1	1	A.
New Mexico	31	T.		1	3	4	2		2	4	5	3	4	1				2			1		1		1	1			1			4		40	17	T.
		A.																																0	0	A.
New York	99	T.	1	14	33	4		1	11	2			1	10	27	12	27	29	1		2		2		3	27	3	5						215	19	T.
		A.																																0	0	A.
North Carolina	56	T.	1		3	2	2	6	20	20	1		2	9	13	3	14	4	1	11	5	8	16	2		8	5	15	21	10	3	9		214	27	T.
		A.																																0	0	A.
North Dakota	48	T.	10	6	1	3	9	1		1	1	6	5	4	5	1	1	3	4	2	2					2					1			68	20	T.
		A.																	2			2												4	2	A.
Ohio	128	T.	11	5	22	2		10	37	16	2	1	26	44	43	24	31	2	1		2	17	10	7	5	4	46	6	8	20	13	19		434	28	T.
		A.																																0	0	A.
Oklahoma	23	T.												2	3	1	2		4	1			1							1	4			19	9	T.
		A.																																0	0	A.
Oregon	74	T.									1			1											1				1					4	4	T.
		A.																																0	0	A.
Pennsylvania	91	T.	2	2	18	4		1	14			1	4	5	27	16	16	14	1		4		5		7	16	16	5		1	1	14		194	23	T.
		A.																																0	0	A.
Rhode Island	7	T.			5	4				2					5	3	3						1											23	7	T.
		A.																																0	0	A.
South Carolina	46	T.	1	1	1	12	1	3	17	22	2			3	1	3	12	10	4	11	14	10	16	2		3	1	19	7			1		177	25	T.
		A.																																0	0	A.
South Dakota	56	T.	14	2		2	6	10	1			6	7	5	5	6	2	2	4	2	2				2	16	14	13	2	1	1	2		127	24	T.
		A.																																0	0	A.
Tennessee	56	T.	3		2	1	3	6	16	14	1		2	5	10	2	7	4		18	2	9	14		1		2	21	7	14	14	14		192	25	T.
		A.																																0	0	A.
Texas	95	T.			3			3	2				1				5		7	5		2	7	2				4	11	20	5	7		84	15	T.
		A.																																0	0	A.
Utah	47	T.	3	1								1	13	8				1												2		6		35	8	T.
		A.																																0	0	A.
Vermont	16	T.		3	7	3									2	1	7	8								2								33	8	T.
		A.																																0	0	A.
Virginia	50	T.		5				1	12	6			6	8	8	1	5	2		5	5	5	13	1		1	4	21	7	8	5	18		147	22	T.
		A.																																0	0	A.
Washington	64	T.		1	4	4	1	1							1	1		1	1	3	1			1	1	2			2	2	2	1		30	18	T.
		A.																													2			2	1	A.
West Virginia	43	T.	4	2	13				8	10	1		2	11	17	6	5	6		11	2	11	5				17	12	5	8	6	17		179	22	T.
		A.																																0	0	A.
Wisconsin	60	T.	11	24	10	1	4	11	4		4	11	3	14	2	13	10		3	6		1	1		2	1	6							142	21	T.
		A.																																0	0	A.
Wyoming	31	T.	2			1	1				1		3		4	1	2		3		1					1	1	4	5	4	2	2		38	17	T.
		A.																																0	0	A.
Sums	2,893	T.	205	205	316	160	142	261	351	171	94	134	257	276	402	250	328	188	107	248	191	188	178	35	89	146	286	214	278	280	218	208		6,406		T.
		A.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	2	2	0		9		A.

Table V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during June, 1902, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	7			0.44														0.44			
Alpena, Mich	25			0.80														*			
Atlanta, Ga	7			0.45									0.45								
Atlantic City, N. J	25-26	8:15 p. m.	3:00 a. m.	1.31	12:55 a. m.	2:00 a. m.	0.35	0.07	0.14	0.18	0.23	0.27	0.31	0.35	0.37	0.43	0.58	0.79	0.92		
Augusta, Ga	7	3:15 p. m.	7:10 p. m.	0.81	3:45 p. m.	4:02 p. m.	T.	0.25	0.45	0.65	0.69										
Do	8	7:10 p. m.	D. N.	0.66	7:27 p. m.	7:40 p. m.	0.07	0.31	0.52	0.54											
Baltimore, Md	7	2:13 p. m.	4:55 p. m.	0.88	2:13 p. m.	2:43 p. m.	0.00	0.13	0.23	0.35	0.60	0.75	0.87								
Binghamton, N. Y	3-4			1.19														0.61			
Bismarck, N. Dak	1	12:20 p. m.	1:05 p. m.	0.65	12:40 p. m.	12:53 p. m.	0.01	0.17	0.46	0.64											
Boise, Idaho	1			0.89														0.09			
Boston, Mass	13			0.31														0.29			
Buffalo, N. Y	12-13	10:15 p. m.	3:20 p. m.	0.62	10:52 p. m.	11:15 p. m.	0.06	0.06	0.21	0.34	0.43	0.45									
Cairo, Ill	30			0.61														0.49			
Charleston, S. C	8-9			0.44														0.26			
Charlotte, N. C	15-16	7:32 p. m.	9:10 a. m.	2.79	11:45 p. m.	1:00 a. m.	0.63	0.06	0.14	0.25	0.31	0.44	0.56	0.60	0.69	0.74	0.83	0.95	1.20	1.39	
Chattanooga, Tenn	18			0.65														0.52			
Chicago, Ill	7	1:50 p. m.	6:15 p. m.	0.69	4:18 p. m.	4:50 p. m.	0.07	0.10	0.22	0.31	0.41	0.50	0.55	0.58							
Cincinnati, Ohio	15	1:10 p. m.	1:55 p. m.	0.66	1:20 p. m.	1:54 p. m.	T.	0.11	0.31	0.49	0.50	0.61	0.66								
Cleveland, Ohio	15	8:10 p. m.	11:50 p. m.	1.40	8:20 p. m.	8:50 p. m.	T.	0.30	0.61	0.78	0.90	0.96	1.02								
Do	25	2:10 p. m.	10:20 p. m.	1.74	3:45 p. m.	4:20 p. m.	0.15	0.07	0.13	0.34	0.50	0.65	0.80	0.84	0.87						
Columbia, Mo	29			0.62														0.29			
Columbia, S. C	15-16			1.90														0.66			
Columbus, Ohio	25	4:42 p. m.	8:10 p. m.	1.54	6:12 p. m.	7:15 p. m.	0.10	0.11	0.20	0.28	0.29	0.31	0.43	0.49	0.59	0.69	0.84	1.14	1.35		
Corpus Christi, Tex	26			1.42														0.52			
Davenport, Iowa	10-11	8:43 p. m.	3:05 a. m.	1.49	2:07 a. m.	2:25 a. m.	0.73	0.11	0.44	0.61	0.65	0.67									
Denver, Colo	28-29			0.98														0.39			
Des Moines, Iowa	5-6	8:45 p. m.	5:55 a. m.	2.14	10:03 p. m.	11:05 p. m.	0.07	0.07	0.12	0.22	0.34	0.48	0.58	0.81	1.02	1.26	1.39	1.53	1.61		
Detroit, Mich	6-7			0.83														0.64			
Dodge, Kans	28-29	11:55 p. m.	5:40 a. m.	1.68	12:02 a. m.	12:50 a. m.	T.	0.20	0.40	0.63	0.81	0.93	1.07	1.17	1.22	1.27	1.31	1.38			
Duluth, Minn	2	2:06 a. m.	10:40 a. m.	1.42	5:30 a. m.	5:50 a. m.	0.36	0.40	0.59	0.72	0.80	0.82									
Eastport, Me	8			0.29														0.21			
Elkins, W. Va	25	9:33 p. m.	11:55 p. m.	1.27	10:10 p. m.	10:45 p. m.	0.05	0.34	0.65	0.78	0.91	0.96	1.02	1.10	1.14						
Erie, Pa	29			1.77														0.37			
Escanaba, Mich	3			0.36														0.30			
Evansville, Ind	15	7:19 p. m.	11:10 p. m.	1.42	7:20 p. m.	8:15 p. m.	T.	0.19	0.34	0.47	0.52	0.58	0.61	0.67	0.73	0.85	0.95	1.03	1.19		
Fort Smith, Ark	27-28			1.00														0.24			
Fort Worth, Tex	27			0.32														0.17			
Galveston, Tex	21	6:15 p. m.	7:20 p. m.	1.36	6:20 p. m.	6:55 p. m.	T.	0.26	0.50	0.78	0.97	1.13	1.24	1.30	1.33						
Do	27	D. N.	5:20 p. m.	5.54	1:40 p. m. 2:30 p. m. 3:20 p. m.	2:30 p. m. 3:20 p. m. 3:45 p. m.	1.93	0.08 1.12 3.11	0.45 1.22 3.33	0.47 1.29 3.41	0.49 1.37 3.50	0.57 1.72 3.56	0.73 1.97	0.78 2.05	0.85 2.27	0.89 2.50	1.04 2.78				
Grand Junction, Colo	28			0.03														0.03			
Green Bay, Wis	1-2	11:20 p. m.	5:35 a. m.	1.23	12:27 a. m.	12:55 a. m.	0.01	0.20	0.31	0.50	0.53	0.59	0.62								
Harrisburg, Pa	25-26			1.61														0.59			
Hatteras, N. C	24-25			0.98														0.64			
Huron, S. Dak	24-25	10:15 p. m.	D. N.	1.55	10:50 a. m.	11:30 p. m.	0.12	0.10	0.51	0.68	0.85	1.05	1.22	1.28	1.32	1.35					
Indianapolis, Ind	7	5:25 p. m.	7:08 p. m.	1.13	5:25 p. m.	5:55 p. m.	0.00	0.06	0.40	0.66	0.92	0.97	1.02	1.04							
Jacksonville, Fla	14	5:15 p. m.	6:48 p. m.	0.49	5:22 p. m.	6:00 p. m.	T.	0.30	0.46	0.49											
Jupiter, Fla	13-14	3:00 p. m.	3:30 a. m.	2.04	6:50 p. m.	7:17 p. m.	0.19	0.11	0.20	0.55	0.68	0.84	0.87								
Kalispell, Mont	3			0.28														0.16			
Kansas City, Mo	20			1.17														0.74			
Key West, Fla	12-13	4:40 a. m.	10:50 a. m.	5.72	3:20 a. m.	3:50 p. m.	3.70	0.06	0.15	0.32	0.58	0.94	1.16	1.18							
Knoxville, Tenn	29	5:15 p. m.	9:05 p. m.	2.11	6:25 p. m.	7:00 p. m.	0.57	0.17	0.38	0.58	0.70	0.86	1.22	1.37	1.39						
La Crosse, Wis	2-3			0.65														0.46			
Lewiston, Idaho	1			0.47														0.07			
Lexington, Ky	18			1.07														0.72			
Lincoln, Nebr	5	1:45 a. m.	10:10 a. m.	2.27	3:00 a. m.	4:20 a. m.	0.06	0.04	0.13	0.22	0.27	0.41	0.53	0.93	1.18	1.40	1.51	1.66	2.04		
Do	14-15	9:33 p. m.	D. N.	1.18	9:34 p. m.	10:18 p. m.	T.	0.18	0.23	0.29	0.39	0.58	0.72	0.83	0.96	1.02					
Little Rock, Ark	28-29	9:45 p. m.	4:30 a. m.	2.65	12:30 a. m. 3:10 a. m.	1:30 a. m. 3:35 a. m.	0.04 0.98	0.11 0.11	0.12 0.26	0.15 0.34	0.16 0.46	0.19 0.59	0.34 0.63	0.51 0.66	0.67 0.69	0.69 0.72	0.73 0.75	0.85 0.77			
Los Angeles, Cal	10			T.																	
Louisville, Ky	15	1:17 p. m.	2:30 p. m.	1.13	1:18 p. m.	2:02 p. m.	T.	0.13	0.21	0.33	0.61	0.81	0.92	0.99	1.01	1.08	1.11				
Macon, Ga	18	6:15 p. m.	7:50 p. m.	1.56	6:15 p. m.	6:55 p. m.	0.00	0.03	0.14	0.28	0.52	0.83	1.14	1.33	1.43	1.44					
Memphis, Tenn	28	10:33 a. m.	2:00 p. m.	1.80	11:35 a. m.	12:50 p. m.	0.07	0.05	0.17	0.24	0.31	0.40	0.53	0.64	0.76	0.91	0.95	1.01	1.58		
Meridian, Miss	18			0.15					0.14												
Milwaukee, Wis	12	5:45 p. m.	11:30 p. m.	1.23	6:35 p. m.	7:10 p. m.	0.05	0.09	0.11	0.11	0.24	0.37	0.55	0.65	0.68						
Montgomery, Ala	18	5:06 p. m.	7:55 p. m.	0.93	5:19 p. m.	5:51 p. m.	T.	0.18	0.29	0.33	0.50	0.50	0.81	0.82							
Nantucket, Mass	22	2:15 a. m.	7:15 a. m.	1.59	2:50 a. m.	4:00 a. m.	0.02	0.14	0.29	0.46	0.64	0.71	0.76	0.81	0.87	0.95	1.04	1.23	1.38		
Nashville, Tenn	29			0.64														0.55			
New Haven, Conn	29			1.07														0.28			
New Orleans, La	21			0.69														0.60			
New York, N. Y	21	2:43 p. m.	3:10 p. m.	0.66	2:47 p. m.	3:07 p. m.	T.	0.17	0.33	0.52	0.66										
Norfolk, Va	26			0.71														0.71			
Northfield, Vt	16			0.44														0.44			
Oklahoma, Okla	21			0.20														0.15			
Omaha, Nebr	5-6	6:00 p. m.	D. N.	1.68	6:17 p. m.	6:30 p. m.	T.	0.13	0.44	0.53											
Palestine, Tex	28			0.32														0.32			
Parkersburg, W. Va	30	3:00 a. m.	8:40 a. m.	1.00	7:15 a. m.	7:55 a. m.	0.10	0.09	0.17	0.18	0.18	0.32	0.58	0.66	0.79	0.82					
Pensacola, Fla	19	3:44 a. m.	4:35 a. m.	1.41	3:45 a. m.	4:15 a. m.	T.	0.19	0.44	0.82	1.00	1.21	1.33	1.35	1.38						
Philadelphia, Pa	25-26	6:18 p. m.	D. N.	1.97	11:33 p. m.	12:35 p. m.	0.63	0.08	0.14	0.19	0.27	0.31	0.38	0.45	0.65	1.01	1.24	1.29			
Pittsburg, Pa	25			1.12														0.64			
Pocatello, Idaho	13			0.20														0.17			
Portland, Me	16-17			0.75														0.47			
Portland, Oreg	1-2			0.45														0.18			
Pueblo, Colo	30			0.31														0.30			
Raleigh, N. C	24-25			0.72														0.42			
Richmond, Va	16	1:25 p. m.	6:50 p. m.	2.59	2:40 p. m. 3:30 p. m.	3:30 p. m. 4:45 p. m.	0.22	0.11 0.92	0.31 0.97	0.41 1.04	0.50 1.16	0.61 1.33	0.66 1.41	0.70 1.47	0.74 1.53	0.81 1.60	0.87 1.68	1.83	2.09	2.20	
Rochester, N. Y	13			0.33														0.33			
St. Louis, Mo	3	6:33 a. m.	9:55 a. m.	0.79	8:07 a. m.	8:25 a. m.	T.	0.23	0.44	0.58	0.67	0.71									
Do	28	6:04 a. m.	9:45 p. m.	4.12	3:10 p. m. 4:00 p. m.	4:00 p. m. 5:20 p. m.	1.21	0.12 0.70	0.16 0.77	0.25 0.87	0.32 0.95	0.39 1.02	0.45 1.08	0.51 1.18	0.57 1.32	0.60 1.43	0.64 1.60	1.70	1.90		
St. Paul, Minn	1			0.52														0.31			
Salt Lake City, Utah	12			0.21								0.21									
San Diego, Cal	27			T.																	
Sandusky, Ohio	15	8:55 p. m.	11:55 p. m.	1.15	9:43 p. m.	10:05 p. m.	0.01	0.20	0.38	0.59	0.71	0.75	0.78	0.80							
San Francisco, Cal †																					
Savannah, Ga	21			0.57														0.47			
Scranton, Pa	16	4:24 p. m.	8:10 p. m.	1.26	5:15 p. m.	5:40 p. m.	0.26	0.29	0.56	0.63	0.67	0.71									
Seattle, Wash	4			0.62														0.60			
Shreveport, La	27-28	1:03 p. m.	9:45 a. m.	8.00	2:35 a. m. 3:25 a. m.	3:25 a. m. 5:10 a. m.	2.35	0.19 2.12	0.32 2.23	0.44 2.32	0.67 2.36	0.85 2.38	1.00 2.50	1.16 2.63	1.41 2.80	1.78 2.97	1.95 3.03	3.09	3.48	3.69	3.86

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Spokane, Wash	1			0.31														*			
Springfield, Ill	1	5:44 a. m.	6:55 a. m.	1.05	5:59 a. m.	6:25 a. m.	T.	0.26	0.52	0.60	0.86	0.94	0.96	0.96	1.02	1.05					
Tampa, Fla	19	3:00 p. m.	4:55 p. m.	1.34	3:55 p. m.	4:35 p. m.	0.32	0.06	0.28	0.62	0.69	0.74	0.85	0.96	1.01						
Do	23	5:00 a. m.	11:25 a. m.	2.28	5:15 a. m.	6:35 a. m.	0.01	0.24	0.32	0.41	0.52	0.61	0.74	0.81	0.88	0.95	1.06	1.16	1.43	1.52	
Toledo, Ohio	12-13			1.06														0.55			
Topeka, Kans	29	5:27 a. m.	7:55 a. m.	1.22	5:55 a. m.	7:25 a. m.	0.09	0.07	0.20	0.32	0.41	0.50	0.58	0.62	0.66	0.71	0.74	0.81	0.97	1.12	
Valentine, Nebr	4	8:09 a. m.	9:05 a. m.	0.68	8:20 a. m.	8:40 a. m.	T.	0.10	0.30	0.48	0.64	0.65									
Vicksburg, Miss	1			0.55						0.54											
Washington, D. C	25-26	9:45 p. m.	2:20 a. m.	1.37	11:25 p. m.	12:10 a. m.	0.21	0.06	0.10	0.17	0.37	0.55	0.66	0.83	0.89	0.98	1.00	1.02			
Wilmington, N. C	25			0.96														0.50			
Yankton, S. Dak	11-12	10:55 p. m.	11:00 a. m.	3.00	11:05 p. m.	11:59 p. m.	0.04	0.06	0.24	0.37	0.46	0.49	0.52	0.61	0.79	1 03	1.12	1.20			
Basseterre, St. Kitts																					
Bridgetown, Barbados	4			1.01														0.59			
Cienfuegos, Cuba	1			0.73														0.73			
Havana, Cuba	12-13	11:55 a. m.	7:25 a. m.	3.51	11:35 p. m.	12:05 a. m.	1.13	0.06	0.11	0.19	0.38	0.57	0.68								
Do	15	11:40 a. m.	8:10 p. m.	1.58	2:08 p. m.	2:50 p. m.	0.32	0.16	0.28	0.43	0.58	0.68	0.74	0.81	0.89						
Do	23	1:35 p. m.	3:02 p. m.	1.30	1:44 p. m.	2:35 p. m.	0.03	0.15	0.23	0.33	0.44	0.50	0.55	0.66	0.82	1.00	1.08				
Puerto Principe, Cuba	9	11:25 a. m.	1:30 p. m.	1.30	12:30 p. m.	1:10 p. m.	0.22	0.07	0.14	0.29	0.59	0.81	0.92	1.00	1.04						
Do	10	2:07 p. m.	3:00 p. m.	0.78	2:10 p. m.	2:40 p. m.	T.	0.04	0.23	0.41	0.51	0.66	0.73								
Do	12	5:36 p. m.	8:05 p. m.	2.96	6:45 p. m.	7:35 p. m.	1.04	0.05	0.17	0.25	0.43	0.59	0.86	1.09	1.41	1.72	1.86	1.91			
Do	18	5:40 p. m.	9:30 p. m.	1.54	6:00 p. m.	6:50 p. m.	0.04	0.07	0.25	0.47	0.67	0.77	0.89	0.97	1.04	1.10	1.14	1.19			
Do	23	6:47 p. m.	8:10 p. m.	1.23	6:51 p. m.	7:20 p. m.	T.	0.16	0.29	0.40	0.64	0.90	1.00	1.05	1.09						
San Juan, Porto Rico	8			1.84														0.68			
Santiago de Cuba, Cuba	1			0.59														0.59			

*Self register not working. †No precipitation during the month.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, June, 1902.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure. Sea level, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.
St. Johns, N. F	29.62	29.76	—.15	48.0	— 3.6	55.0	41.0	7.19	+3.59	
Sydney, C. B. I	29.77	29.81	—.14	52.2	— 3.2	61.4	43.1	3.20	—0.03	
Halifax, N. S	29.72	29.82	—.13	55.6	— 2.1	64.2	46.9	4.91	+1.15	
Grand Manan, N. B	29.75	29.80	—.13	57.0	+ 0.8	63.6	50.3	3.27	+0.33	
Yarmouth, N. S	29.77	29.84	—.11	53.6	— 1.4	60.6	46.6	5.38	+2.62	
Charlottetown, P. E. I	29.76	29.80	—.12	55.0	— 2.4	63.2	46.8	3.78	+1.11	
Chatham, N. B	29.74	29.76	—.13	54.8	— 5.2	65.7	44.0	6.44	+2.98	
Father Point, Que	29.74	29.76	—.11	50.4	— 2.6	58.5	42.2	8.15	+5.17	
Quebec, Que	29.47	29.78	—.14	56.9	— 4.3	66.2	47.5	6.16	+2.51	
Montreal, Que	29.61	29.81	—.13	60.0	— 4.9	68.3	51.7	5.71	+2.18	
Bissett, Ont	29.25	29.85	—.09	57.0	— 4.6	69.7	44.4	2.90	—0.26	
Ottawa, Ont	29.56	29.88	—.06	60.6	— 4.7	69.9	51.3	4.29	+1.37	
Kingston, Ont	29.54	29.85	—.12	58.3	— 5.1	66.0	50.6	4.17	+1.74	
Toronto, Ont	29.50	29.87	—.10	60.0	— 3.4	70.1	49.9	3.55	+0.75	
White River, Ont	28.56	29.87	—.07	51.2	— 7.5	63.6	38.8	3.44	+1.22	
Port Stanley, Ont	29.27	29.91	—.06	59.9	— 3.9	68.8	50.9	5.95	+3.22	
Saugeen, Ont	29.18	29.88	—.09	57.5	— 2.9	66.6	48.3	3.40	+1.05	
Parry Sound, Ont	29.17	29.85	—.11	58.1	— 3.6	67.3	48.9	4.76	+2.34	
Port Arthur, Ont	29.18	29.89	—.05	52.6	— 3.8	61.9	43.4	5.18	+2.45	
Winnipeg, Man	29.06	29.88	—.01	57.0	— 5.2	67.1	46.9	3.46	+0.17	
Minnedosa, Man	28.11	29.91	+.02	54.3	— 5.3	64.8	43.7	6.30	+3.30	
Qu'Appelle, Assin	27.66	29.89	+.02	53.0	— 6.9	63.0	43.0	4.54	+1.12	
Medicine Hat, Assin	27.65	29.92	+.07	56.6	— 5.4	67.8	45.4	3.17	+0.41	
Swift Current, Assin	27.37	29.92	+.05	55.2	— 4.8	63.4	47.0	4.47	+1.80	1.0
Calgary, Alberta	26.39	29.90	+.06	49.4	— 6.6	58.4	40.3	8.82	+6.37	T.
Banff, Alberta	25.33	29.89	+.05	47.8	— 3.7	58.6	37.0	5.12	+1.79	6.6
Edmonton, Alberta	27.64	29.91	+.07	52.4	— 4.5	63.7	41.1	1.95	—0.91	T
Prince Albert, Sask	28.35	29.90	+.03	52.6	— 5.1	64.0	41.1	4.19	+1.68	
Battleford, Sask	28.21	29.94	+.08	52.1	— 7.4	63.7	40.5	2.35	—0.96	T.
Kamloops, B. C	28.66	29.87	.00	61.0	— 2.8	73.0	48.9	1.10	—0.32	
Victoria, B. C	29.92	30.02	+.01	57.3	+ 1.0	64.1	50.4	0.08	—1.12	
Barkerville, B. C	25.64	29.93	+.06	47.3	— 3.4	58.7	35.9	3.56	+0.08	
Hamilton, Bermuda										

TABLE VII.—*Heights of rivers referred to zeros of gages, June, 1902.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	6.8	9,10	4.7	30	5.9	2.1
Reeds Landing, Minn	1,884	12	5.3	11	3.7	27,28	4.5	1.6
La Crosse, Wis	1,819	12	6.6	1	4.8	29,30	5.9	1.8
Prairie du Chien, Wis	1,759	18	9.3	1,2	4.9	30	6.8	4.4
Dubuque, Iowa	1,699	15	10.2	1	5.8	29,30	7.8	4.4
Leclaire, Iowa	1,609	10	7.0	4	4.5	25,26,29,30	5.6	2.5
Davenport, Iowa	1,593	15	9.3	5	5.4	30	7.3	3.9
Muscatine, Iowa	1,562	16	11.0	6	6.8	30	8.9	4.2
Galland, Iowa	1,472	8	6.0	1,2	3.9	27	5.1	2.1
Keokuk, Iowa	1,463	15	10.3	2	6.6	27	8.8	3.7
Hannibal, Mo	1,402	13	11.4	3	8.0	27	10.0	3.4
Grafton, Ill	1,306	23	14.3	30	11.8	27	13.0	2.5
St. Louis, Mo	1,264	30	21.2	30	17.4	2	19.2	3.8
Chester, Ill	1,189	30	17.8	30	14.0	2	15.5	3.8
New Madrid, Mo	1,003	34	19.6	1,2	16.1	25,26	17.6	3.5
Memphis, Tenn	843	33	15.7	4	11.8	28	13.7	3.9
Helena, Ark	767	42	22.5	6,7	18.2	1,28	20.3	4.3
Arkansas City, Ark	635	42	27.7	7	21.0	1,28	26.8	6.7
Greenville, Miss	595	42	22.8	7	17.1	1,29	20.0	5.7
Vicksburg, Miss	474	45	25.4	9	17.4	1	22.4	8.0
New Orleans, La	108	16	8.0	13-15	5.4	1	7.0	2.6
Missouri River.								
Bismarck, N. Dak	1,309	14	9.3	4,7	6.2	1	7.9	3.1
Pierre, S. Dak	1,114	14	9.2	10	6.2	3	8.0	3.0
Sioux City, Iowa	784	19	12.4	12	9.2	7	11.1	3.2
Omaha, Nebr	669	18	12.4	14	9.9	8	11.3	2.5
Plattsmouth, Nebr	641	17	8.5	10-14	6.6	7	7.5	1.9
St. Joseph, Mo	481	10	8.6	11	5.6	2	7.2	3.0
Kansas City, Mo	388	21	19.0	11	13.8	4	16.3	5.2
Boonville, Mo	199	20	15.5	13	12.0	8	13.3	3.5
Hermann, Mo	103	24	16.2	30	11.4	1	13.3	4.8
Osage River.								
Bagnell, Mo	70	28	10.2	7	2.5	20	7.1	7.7
Illinois River.								
Peoria, Ill	135	14	16.0	17-19	11.8	2,3	14.6	4.2
Youghiogheny River.								
Confluence, Pa	59	10	2.6	21	0.8	5-8	1.3	1.8
West Newton, Pa	15	23	1.4	1,9	0.6	24-26	0.9	0.8
Allegheny River.								
Warren, Pa	177	14	4.5	30	1.0	9-15	1.7	3.5
Oil City, Pa	123	13	4.9	30	1.4	10-12,15	2.1	3.5
Parker, Pa	73	20	4.6	30	1.3	11-13	2.0	3.3
Monongahela River.								
Weston, W. Va	161	18	3.3	26	—0.5	16	0.2	3.8
Fairmont, W. Va	119	25	2.9	27,28	1.2	8-21	1.6	1.7
Greensboro, Pa	81	18	8.6	28	6.8	11-16	7.3	1.8
Lock No. 4, Pa	40	28	10.0	29	6.9	10	8.2	3.1
Conemaugh River.								
Johnstown, Pa	64	7	3.2	30	0.8	24,25	1.4	2.4
Red Bank Creek.								
Brookville, Pa	35	8	3.6	30	0.2	1-13	0.8	3.4
Beaver River.								
Elwood Junction, Pa	10	14	4.5	30	3.0	18	3.4	1.5
Great Kanawha, River.								
Charleston, W. Va	58	30	8.2	27	3.8	3	6.6	4.4
Little Kanawha River.								
Glenville, W. Va	103	20	5.2	26	—2.5	18	0.0	7.7
New River.								
Hinton, W. Va	95	14	4.0	29,30	1.6	8	2.2	2.4
Cheat River.								
Rowlesburg, W. Va	36	14	4.6	27	1.6	16	3.0	3.0
Ohio River.								
Pittsburg, Pa	966	22	7.0	29	5.2	20	6.1	1.8
Davis Island Dam, Pa	960	25	6.0	30	3.5	11-13	4.3	2.5
Wheeling, W. Va*	875	36	7.9	30	3.8	13	5.2	4.1
Parkersburg, W. Va	785	36	9.2	30	3.8	13	5.8	5.4
Point Pleasant, W. Va	703	39	10.5	30	3.5	10	5.8	7.0
Huntington, W. Va	660	50	14.5	30	6.6	10	9.3	7.9
Catlettsburg, Ky	651	50	14.7	30	5.2	8	8.1	9.5
Portsmouth, Ohio	612	50	18.3	30	6.8	8	9.6	11.5
Cincinnati, Ohio	499	50	22.0	30	8.0	13-15	11.0	14.0
Madison, Ind	413	46	20.8	30	7.9	17	10.2	13.1
Louisville, Ky	367	28	9.6	30	4.8	17,18	5.9	4.8
Evansville, Ind	184	35	14.1	1	5.9	20,21	8.2	8.2
Paducah, Ky	47	40	12.8	2	6.2	24,25	8.3	6.6
Cairo, Ill	1,073	45	23.4	1	18.6	25	20.6	4.8
Muskingum River.								
Zanesville, Ohio	70	20	9.4	30	5.8	6-10,13	6.5	3.6
Scioto River.								
Columbus, Ohio	110	17	6.1	30	2.9	2-6	3.3	3.2
Miami River.								
Dayton, Ohio	77	18	6.2	30	0.6	25	1.3	5.6
Wabash River.								
Mount Carmel, Ill	50	15	8.0	1	3.1	25-27	5.0	4.9
Licking River.								
Falmouth, Ky	30	25	6.6	29	1.8	26	2.6	4.8
Kentucky River.								
Frankfort, Ky	65	31	9.9	30	6.1	18	6.6	3.8
Clinch River.								
Speers Ferry, Va	156	20	4.8	28	—0.3	6,7	0.8	5.1
Clinton, Tenn	52	25	13.5	30	4.0	4-8,17,18	4.8	9.5
Holston River.								
Rogersville, Tenn	103	14	10.4	28	1.7	7	2.7	8.7
French Broad River.								
Leadvale, Tenn	70	15	4.0	30	0.0	1,2,5-7, 11-14,20, 21,23-26	0.7	4.0
Tennessee River.								
Knoxville, Tenn	635	29	9.8	24	1.4	7,14	2.5	8.4
Kingston, Tenn	556	25	7.2	30	2.1	1-17	2.5	5.1
Chattanooga, Tenn	452	33	5.0	30	3.0	16-18	3.7	2.0
Bridgeport, Ala	402	24	2.8	21	1.4	17,18	1.9	1.4
Tennessee River.—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Florence, Ala	255	16	2.7	6	1.4	18-20	1.9	1.3
Riverton, Ala	225	25	2.9	2	0.6	20	1.6	2.3
Johnsonville, Tenn	95	24	5.2	1	2.2	20-22	3.0	3.0
Cumberland River.								
Burnside, Ky	516	50	2.8	30	1.2	14	1.8	1.6
Carthage, Tenn	305	40	5.0	30	1.3	17,18	1.8	3.7
Nashville, Tenn	189	40	6.7	30	2.0	19,20	2.7	4.7
Clarksville, Tenn	126	42	5.6	3	3.0	21-23,25,26	4.0	2.6
Arkansas River.								
Wichita, Kans	832	10	5.9	3	1.9	1	3.2	4.0
Webbers Falls, Ind. T	465	23	15.5	1	6.2	21,30	11.0	9.3
Fort Smith, Ark	403	22	18.0	1	6.9	30	11.7	11.1
Dardanelle, Ark	256	21	17.4	2	6.4	23	11.8	11.0
Little Rock, Ark	176	23	18.4	3	8.3	24	13.3	10.1
White River.								
Newport, Ark	150	26	4.3	27	1.7	17	3.1	2.6
Yazoo River.								
Yazoo City, Miss	80	25	2.5	11	—0.4	25-28	1.0	2.9
Red River.								
Arthur City, Tex	638	27	27.3	1	6.2	27	11.6	21.1
Fulton, Ark	515	28	29.4	6	8.0	27	17.9	21.4
Shreveport, La	327	29	17.6	14,15	9.3	1	14.7	8.3
Alexandria, La	118	33	15.2	15,16	6.5	3	12.0	8.7
Ouachita River.								
Camden, Ark	304	39	18.1	30	4.5	21	8.2	13.6
Monroe, La	122	40	13.2	8	1.7	27	6.3	11.5
Atchafalaya River.								
Melville, La	100	31	24.6	13	19.0	2	22.3	5.6
Susquehanna River.								
Wilkesbarre, Pa	183	14	5.1	30	3.8	5,6	4.2	1.3
Harrisburg, Pa	69	17	3.0	30	1.2	8	1.9	1.8
West Branch Susquehanna.								
Williamsport, Pa	39	20	4.3	30	0.6	25	1.6	3.7
Juniata River.								
Huntingdon, Pa.	90	24	4.8	26,30	3.0	7-11,25	3.2	1.8
Potomac River.								
Cumberland, Md.	290	8	2.7	1,2,12	1.6	25	2.1	1.1
Harpers Ferry, W. Va	172	18	1.0	1-4	—0.5	17-21,30	1.1	1.5
James River.								
Lynchburg, Va	260	18	1.7	16	0.3	11,12,24,25	0.7	1.4
Richmond, Va	111	12	4.2	17	0.2	29,30	0.7	4.0
Roanoke River.								
Weldon, N. C	129	30	27.7	19	8.6	14	10.5	19.1
Cape Fear River.								
Fayetteville, N. C	112	38	8.0	18	1.9	15,16	3.4	6.1
Edisto River.								
Edisto, S. C	75	6	4.9	22-25	3.0	14-16	3.7	1.9
Pedee River.								
Cheraw, S. C	149	27	27.2	19	1.7	7	5.1	25.5
Black River.								
Kingstree, S. C	52	12	4.0	1	0.8	30	1.8	3.2
Lynch Creek.								
Effingham, S. C	35	12	5.2	2,28	3.2	20	4.0	2.0
Santee River.								
St. Stephens, S. C	97	12	8.7	27,28	2.6	16	5.3	6.1
Congaree River.								
Columbia, S. C	37	15	12.1	17	0.0	15	1.8	12.1
Wateree River.								
Camden, S. C	45	24	28.9	18	5.6	7	9.2	23.3
Waccamaw River.								
Conway, S. C	40	7	2.5	10	1.2	20	1.8	1.3
Savannah River.								
Calhoun Falls, S. C	347	15	5.0	16	1.4	11-14	2.2	3.6
Augusta, Ga	268	32	15.9	17	7.5	29,30	8.9	8.4
Broad River.								
Carlton, Ga	30	11	3.3	16	2.3	29,30	2.6	1.0
Flint River.								
Albany, Ga	80	20	4.3	18	1.8	5,6	2.0	2.5
Chattahoochee River.								
Westpoint, Ga	239	20	4.6	1	2.1	30	2.7	2.5
Ocmulgee River.								
Macon, Ga	125	18	6.2	8	3.4	29,30	4.3	2.8
Oconee River.								
Dublin, Ga	79	30	4.5	17,18	0.2	30	1.8	4.3
Coosa River.								
Rome, Ga	271	30	2.0	9	1.0	29,30	0.9	1.0
Gadsden, Ga	144	18	1.1	1,19,20	0.5	26-30	0.8	0.6
Alabama River.								
Montgomery, Ala	265	35	3.0	3	1.0	30	2.0	2.0
Selma, Ala	212	35	4.0	4,5	1.7	30	2.6	2.3
Tombigbee River.								
Columbus, Miss	303	33	3.2	17-20,30	2.5	2,3	2.7	0.7
Demopolis, Ala	155	35	1.6	2,3	—1.0	30	0.0	2.6
Black Warrior River.								
Tuscaloosa, Ala	90	43	1.8	24,25	0.4	29,30	1.1	1.4
Brazos River.								
Kopperl, Tex	369	21	5.3	2	—0.2	20-24	0.9	5.5
Waco, Tex	301	24	8.6	5	3.1	26	4.9	5.5
Booth, Tex	76	39	8.8	1	1.4	25,26	4.4	7.4
Red River of the North.								
Moorhead, Minn.	418	26	10.1	10-12	9.1	2,3	9.7	1.0
Columbia River.								
Umatilla, Oreg.	270	25	21.6	1	16.3	30	18.8	5.3
The Dalles, Oreg	166	40	36.8	1	26.5	30	31.6	11.2
Willamette River.								
Albany, Oreg	118	20	5.6	1,2	2.5	28-30	3.9	3.1
Portland, Oreg.	12	15	20.8	4	14.6	30	18.1	6.2
Sacramento River.								
Red Bluff, Cal	265	23	3.6	1,2	1.5	30	2.3	2.1
Sacramento, Cal	64	29	20.9	2	13.6	30	18.1	7.3

* 1 day missing.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San Jose de Costa Rica, during June, 1902.*

Hours.	Pressure. Observed, 1902.	Pressure. Normal, 1889–1900.	Temperature. Observed, 1902.	Temperature. Normal, 1889–1900.	Relative humidity. Observed, 1902.	Relative humidity. Normal, 1889–1900.	Rainfall. Observed, 1902.	Rainfall. Normal, 1889–1900.	Rainfall. Duration, 1902.
	660+ Mm.	660+ Mm.	° C.	° C.	%	%	Mm.	Mm.	Hrs.
1 a. m	3.28	3.85	17.94	17.80	94	93	0.2	2.1	0.41
2 a. m	2.92	3.44	17.74	17.64	94	93	1.3	1.7	0.75
3 a. m	2.64	3.23	17.49	17.40	93	93	0.7	1.4	1.17
4 a. m	2.43	2.94	17.34	17.16	93	93	0.7	1.2	2.25
5 a. m	2.47	2.99	17.16	17.07	93	93	1.5	1.1	1.50
6 a. m	2.60	3.21	16.81	16.90	94	93	1.5	0.9	1.00
7 a. m	2.87	3.55	17.12	17.13	93	90	0.1	0.4	1.00
8 a. m	3.11	3.84	18.82	19.50	85	84	0.0	0.5	0.00
9 a. m	3.41	4.05	21.39	21.25	74	78	0.0	0.9	0.00
10 a. m	3.64	4.14	23.12	23.10	72	70	0.0	1.9	0.00
11 a. m	3.58	4.05	24.79	24.32	63	67	0.7	2.0	0.83
Noon	3.36	3.80	25.77	24.98	62	68	0.6	4.3	0.83
1 p. m	2.96	3.46	25.24	25.05	66	68	2.2	10.1	0.42
2 p. m	2.49	3.05	24.81	24.52	69	71	10.5	27.0	2.32
3 p. m	2.15	2.72	23.86	23.20	74	76	19.3	28.8	4.03
4 p. m	1.91	2.50	22.33	21.90	81	81	33.1	53.1	7.25
5 p. m	2.09	2.62	21.17	20.85	86	85	20.6	41.4	9.75
6 p. m	2.38	2.97	20.50	20.10	89	88	29.2	48.6	9.11
7 p. m	2.70	3.30	19.80	19.48	92	89	32.7	24.7	10.60
8 p. m	3.08	3.72	19.41	19.06	92	92	8.0	18.9	6.67
9 p. m	3.29	3.99	19.04	18.79	94	92	6.2	10.2	6.75
10 p. m	3.40	4.16	18.73	18.50	95	93	4.3	4.0	4.60
11 p. m	3.53	4.28	18.49	18.27	94	93	3.3	3.4	1.25
Midnight	3.54	4.15	18.17	18.02	95	93	2.8	2.3	1.08
Mean	662.91	663.50	20.25	20.08	85	85	......	......	......
Minimum	660.6	660.73	14.5	13.2	53	......	......	......	......
Maximum	664.8	666.12	28.9	29.5	100	......	17.0	......	......
Total	......	......	......	......	......	......	179.5	290.6	73.57

REMARKS.—At San Jose the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard register. ing instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San Jose have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San Jose local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San Jose local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.

Time.	Sunshine. Observed, 1902.	Sunshine. Normal, 1889–1900.	Cloudiness. Observed, 1902.	Cloudiness. Normal, 1889–1900.	Temperature of the soil at depth of— 0.15 m.	0.30 m.	0.60 m.	1.20 m.	3.00 m.
	Hours.	Hours.	%	%	° C.	° C.	° C.	° C.	° C.
7 a. m	7.41	9.79	60	59	21.56	21.93	22.51	21.99	21.42
8 a. m	16.37	17.25	......	......	......	......	......	......	......
9 a. m	19.59	19.58	......	......	......	......	......	......	......
10 a. m	21.48	19.30	74	66	21.72	21.96	22.52	22.01	......
11 a. m	18.71	17.75	......	......	......	......	......	......	......
Noon	11.33	14.09	......	......	......	......	......	......	......
1 p. m	6.76	11.58	87	84	22.27	22.07	22.50	22.01	......
2 p. m	10.12	10.52	......	......	......	......	......	......	......
3 p. m	7.12	7.01	......	......	......	......	......	......	......
4 p. m	4.18	4.35	94	94	22.43	22.15	22.50	21.99	......
5 p. m	1.99	1.67	......	......	......	......	......	......	......
6 p. m	0.88	0.39	......	......	......	......	......	......	......
7 p. m	......	......	90	92	22.33	22.17	22.50	21.96	......
8 p. m	......	......	......	......	......	......	......	......	......
9 p. m	......	......	......	......	......	......	......	......	......
10 p. m	......	......	70	81	22.16	22.14	22.49	21.96	......
11 p. m	......	......	......	......	......	......	......	......	......
Midnight	......	......	......	......	......	......	......	......	......
Mean	......	......	79	79	22.11	22.07	22.51	21.98	21.42
Total	125.94	133.28	......	......	......	......	......	......	......

TABLE 3.—*Rainfall at stations in Costa Rica, June, 1902.*

Stations.	Height above sea level.	Observed, 1902. Amount.	Observed, 1902. Number of days.	Normals. Number of years.	Normals. Amount.	Normals. Number of days.
	Meters.	Mm.			Mm.	
Sipurio (Talamanca)	60	*	*	1	255	21
Boca Banano	3	176	13	6	148	15
Port Limon	3	264	12	7	147	15
Swamp Mouth	3	116	6	4	97	11
Zent	20	81	12	1	50	20
Siquirres	60	340	17	3	276	20
Dos Novillos	137	258	18	......	......	......
Guapiles	300	275	21	2	270	19
Cariblanco (Sarapiqui)	835	576	27	4	512	27
San Carlos	161	285	15	4	311	22
Las Lomas	266	257	12	2	282	11
Peralta	332	214	20	4	379	20
Turrialba	620	240	20	7	307	19
Juan Viñas	1,040	179	21	6	191	16
Santiago	1,100	153	19	1	227	17
Paraiso	1,336	249	18	......	......	......
Cachi	1,020	222	23	......	......	......
Las Concavas	1,337	*	*	......	......	......
Cartago	1,450	*	*	2	147	17
Tres Rios	1,300	301	23	12	285	18
San Francisco Guadal	1,187	214	22	6	308	22
San Jose	1,160	180	24	13	290	22
La Verbena	1,140	306	22	6	322	22
Nuestro Amo	791	216	17	6	264	21
Alajuela	950	330	19	2	240	14
San Isidro Alajuela	1,346	......	......	1	383	28

* Not received.

TABLE 4.—*Observations taken at Port Limon and Zent, June, 1902.*

Stations.	Pressure. Minimum.	Pressure. Maximum.	Pressure. Mean.	Temperature. Minimum.	Temperature. Maximum.	Temperature. Mean.	Relative humidity.
	Inches.	Inches.	Inches.	°	°	°	%
Port Limon	......	......	......	22.1	35.0	26.79	84
Zent	......	......	......	20.5	40.0	26.58	84

Stations.	Cloudiness.	Sunshine.	Rainfall. Amount.	Rainfall. Number of days.	Temperature of soil at depth of— 0.15 m.	0.30 m.	0.60 m.
	%	Hours.	Mm.		°	°	°
Port Limon	63	......	264	12	......	......	......
Zent	60	200.47	81	12	28.30	27.88	27.52

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

June, 1902.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Temperature. Min.	Temperature. Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Prevailing direction. Cloud.
	Feet.	Inch.	° F.	° F.	° F.	%	Inch.		
Chihuahua	4,684	25.15	97.7	64.4	80.6	44	0.64	se.	......
Colima	1,600	28.35	98.4	66.4	80.6	73	3.19	s.	......
Guadalajara (Obs. del Est.)	5,186	24.83	94.5	59.5	75.9	55	6.12	nnw.	......
Guanajuato	6,640	23.58	94.1	55.8	71.4	46	1.06	ene.	......
Leon (Guanajuato)	5,906	24.21	94.1	52.9	74.3	53	2.43	ese.	......
Mazatlan	25	29.74	90.0	73.9	82.9	73	0.81	nw.	e.
Mexico (Obs. Cent.)	7,472	22.95	85.8	51.8	64.9	57	2.15	n.	ne.
Monterrey	1,626	28.02	108.7	67.1	85.3	60	0.52	se.	......
Morelia (Seminario)	6,401	23.99	87.8	57.2	67.5	52	1.74	e.	e.
Puebla (Col. Cat.)	7,108	23.28	82.8	55.4	67.1	69	6.78	ne., e.	......
Puebla (Col. d Est.)	7,118	23.26	82.0	47.7	64.2	70	8.11	e.	......
Queretaro	6,070	24.06	92.8	56.3	69.8	55	1.02	e.	......
Saltillo (Col. S. Juan)	5,399	24.67	100.6	62.4	76.3	54	0.04	nne.	......
S. Isidro (Hac. de Gto.)	......	......	83.3	71.6	......	......	1.35	ne.	......
Toluca	8,812	21.88	85.1	43.2	60.6	60	4.41	ne	......

Chart I. Tracks of Centers of High Areas. June, 1902.

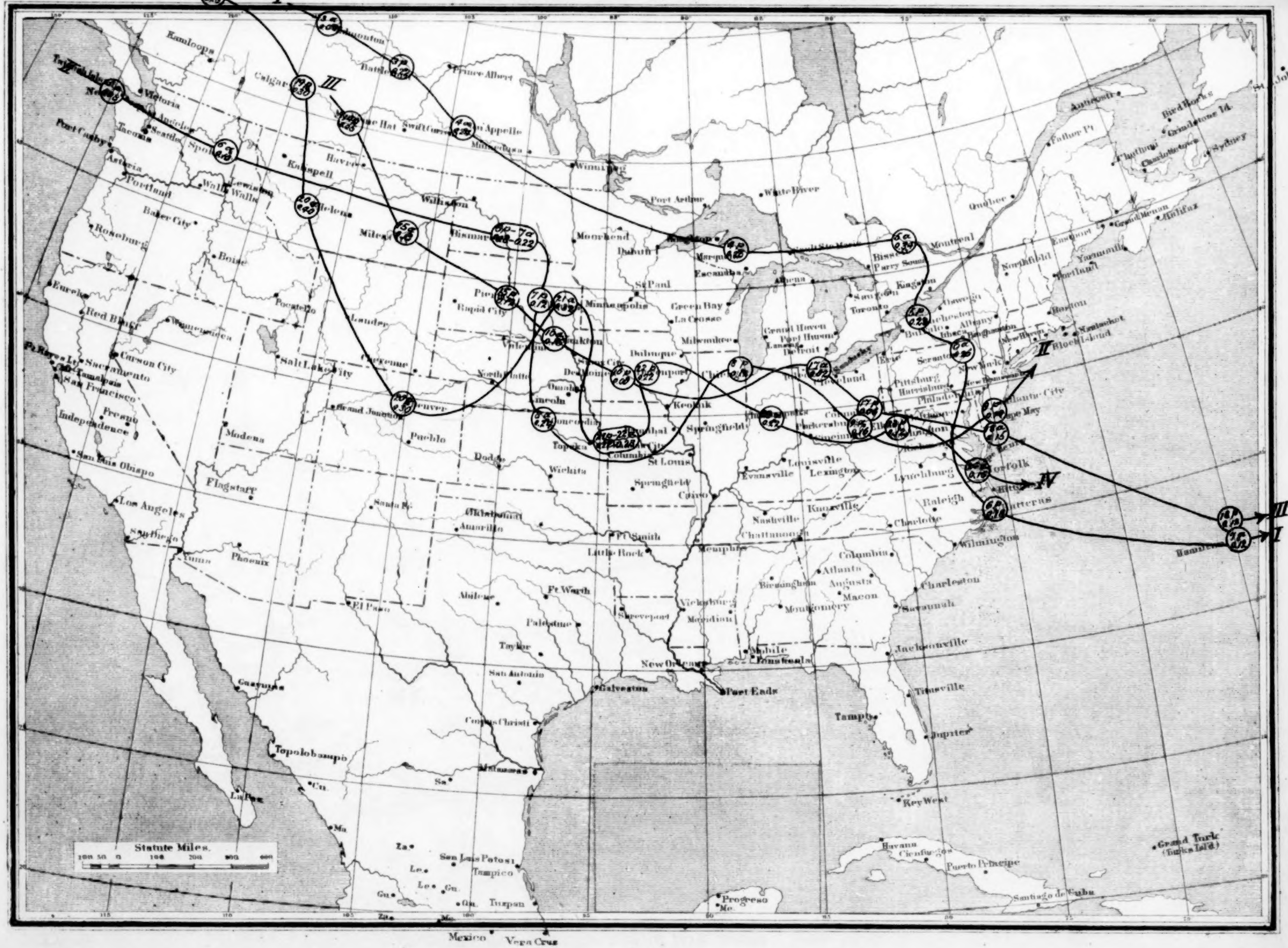


Chart II. Tracks of Centers of Low Areas. June, 1902.

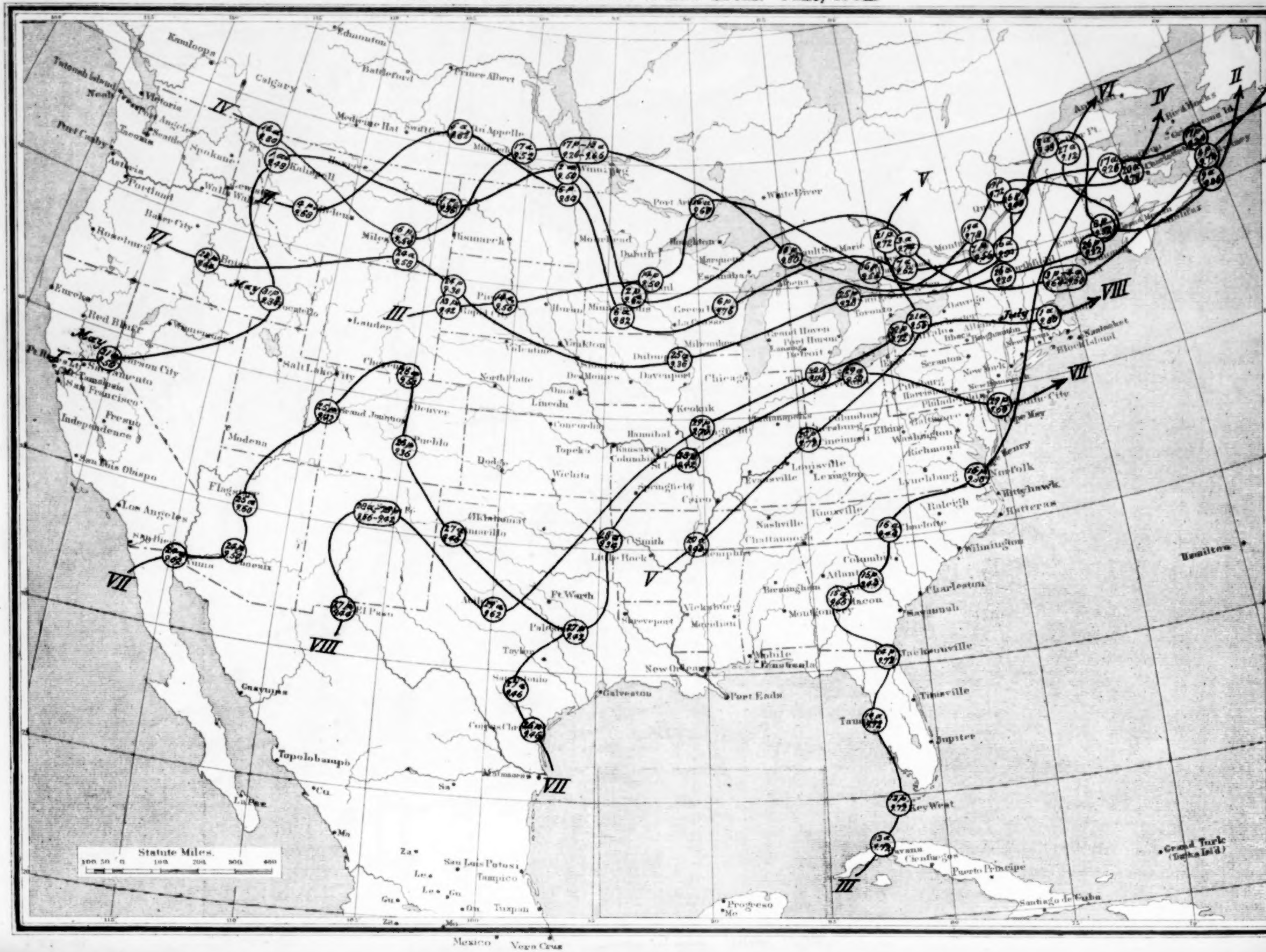


Chart III. Total Precipitation. June, 1902.

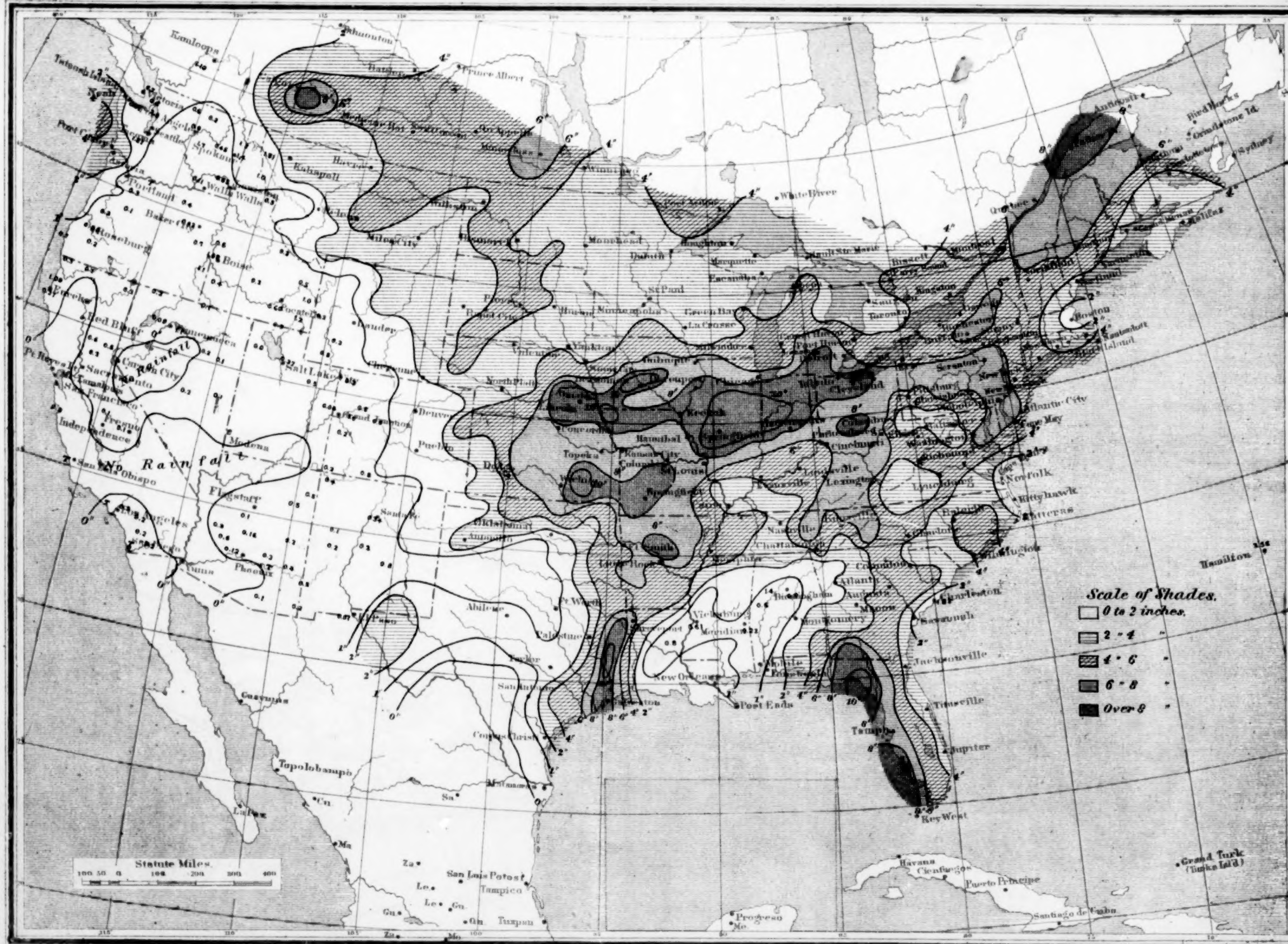


Chart IV. Sea-Level Pressure; Resultant Surface Winds. June, 1902.

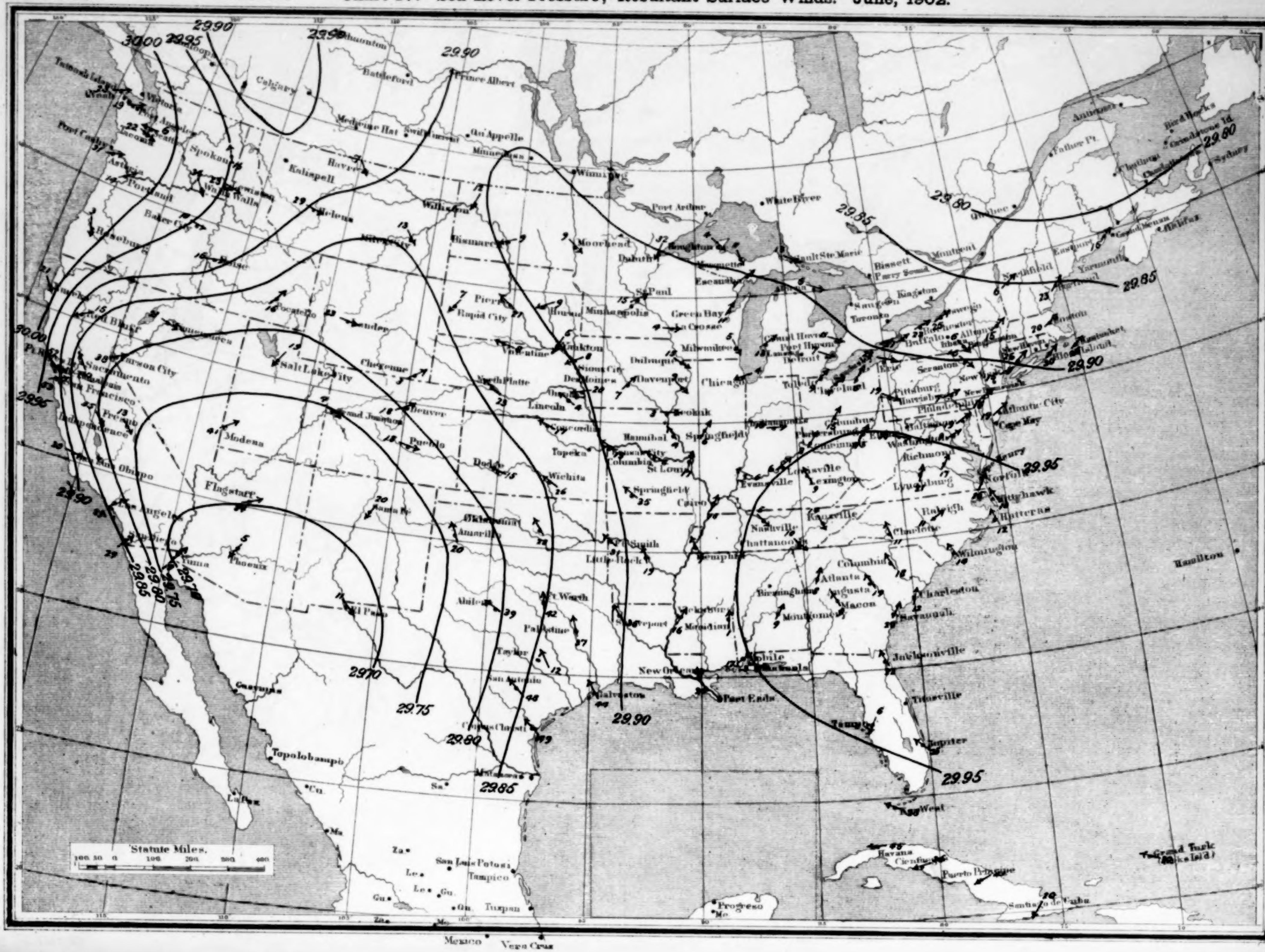


Chart V. Hydrographs for Seven Principal Rivers of the United States. June, 1902.

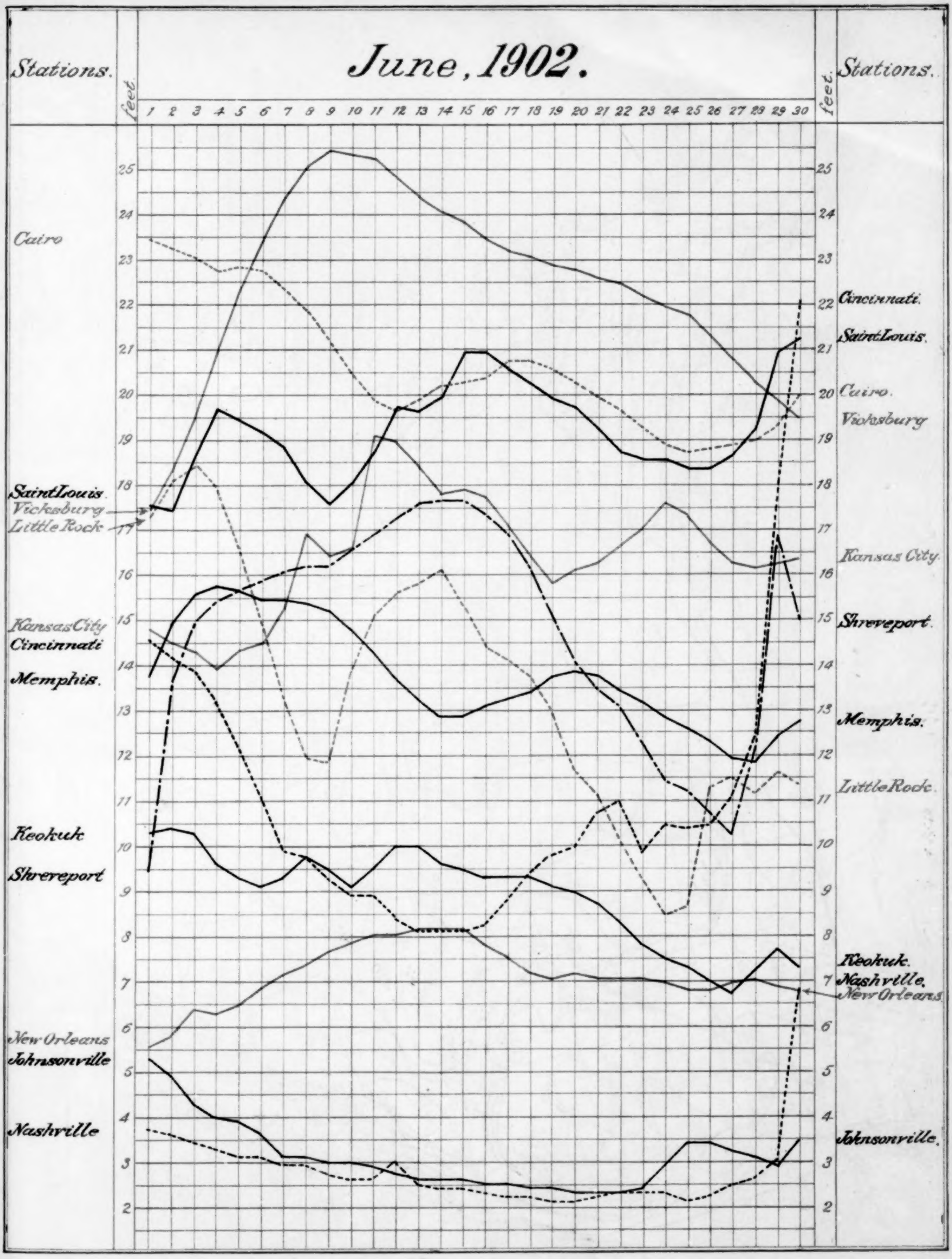


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. June, 1902.

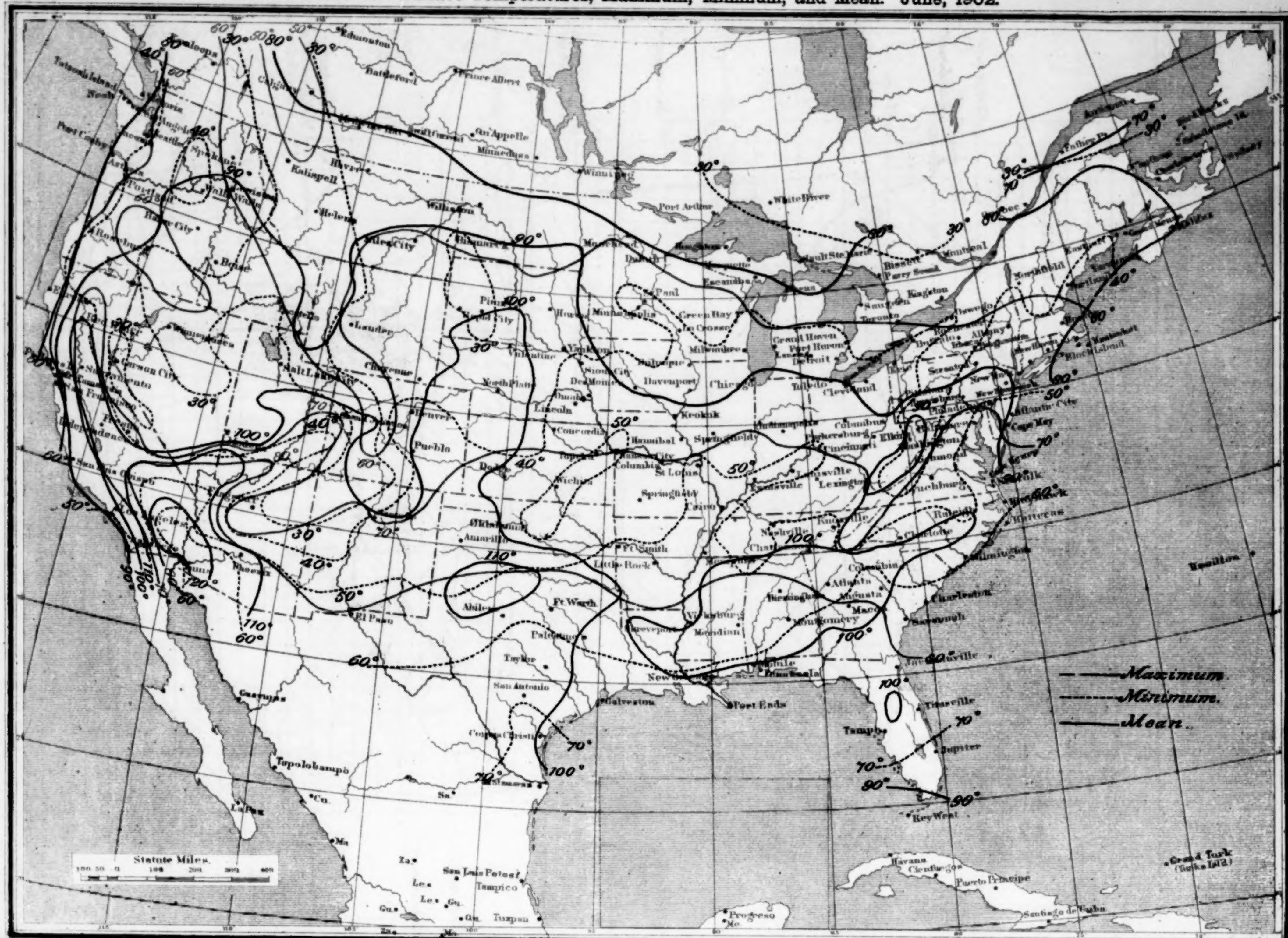


Chart VII. Percentage of Sunshine. June, 1902.

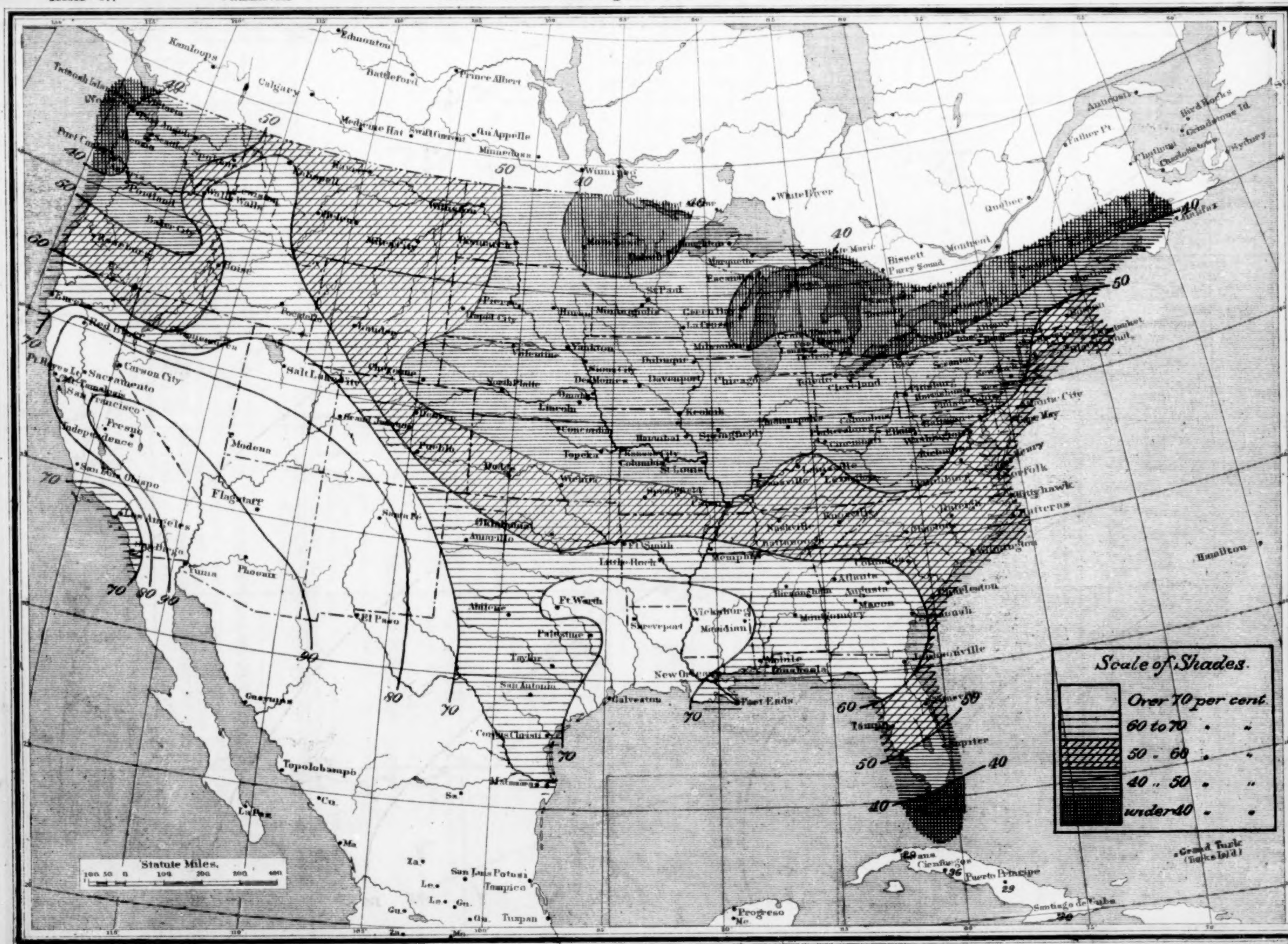


Chart VIII. West Indian Monthly Isobars, Isotherms, and Resultant Winds. June, 1902.